To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
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Subject: 06-274r0 SPC-4 SBC-3 REQUEST SENSE and Stopped power condition

Revision history

Revision 0 (9 June 2006) First revision

Related documents

spc4r04 - SCSI Primary Commands - 4 (SPC-4) revision 4
sbc3r05 - SCSI Block Commands - 3 (SBC-3) revision 5

Overview

While a logical unit is in the idle or standby power condition, it responds (per SPC-4) to a REQUEST SENSE command by returning parameter data containing sense data with the sense key set to NO SENSE and the additional sense code set to one of the following values based on the power condition and the reason it is in that power condition:

a) LOW POWER CONDITION ON;
b) IDLE CONDITION ACTIVATED BY TIMER;
c) STANDBY CONDITION ACTIVATED BY TIMER; or
d) IDLE CONDITION ACTIVATED BY COMMAND

While a direct-access block device (compliant with SBC-3) is in the idle or standby power condition, it has all those options plus an additional sense code of STANDBY CONDITION ACTIVATED BY COMMAND. While it is in the stopped power condition (which is specific to that peripheral device type), however, no particular sense key/additional sense code is specified. Two are plausible:

a) NO SENSE/NO ADDITIONAL SENSE INFORMATION: this is what is returned (per SPC-4) if there is no other sense data to return and seems to be the convention today;
b) NOT READY/ LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED: this would parallel what idle and standby power conditions return. SBC-2 section 4.15.2.6.1 says:

   "While in [the Stopped] state: a) the device server is not capable of processing medium access commands. Any medium access commands received while in this state shall cause the device server to terminate the command with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED;"

   REQUEST SENSE is not usually considered a "medium access command" so it's likely that a device server would return this sense key/additional sense code combination.

   TEST UNIT READY can be used to detect the stopped power condition (it is treated as a medium access command) but does not provide information about the idle and standby power conditions.

SBC-3 should be specific about which are valid. This proposal allows for both.

Suggested changes to SPC-4

5.9 Power conditions

5.9.1 Power conditions overview

The optional Power Condition mode page (see 7.4.12) allows an application client to control the power condition of a logical unit in a manner that may reduce power consumption of the SCSI target device. This control is invoked by enabling and setting the idle condition timer and/or the standby condition timer using the mode page. A change in the power condition of any logical unit in a SCSI target device may result in a change in the SCSI target device's power consumption.

In addition to the Power Condition mode page, the power condition of a logical unit may be controlled by the START STOP UNIT command (see SBC-2 or RBC). If both the Power Condition mode page and the START STOP UNIT command methods are being used to control the power condition of the same logical unit, then

~~any START STOP UNIT command's power condition specification~~the power condition specified by any START STOP UNIT command shall override the Power Condition mode page's power control ~~and may disable the idle condition and standby condition timers~~.

There shall be no notification to the application client that a logical unit has transitioned from one power condition to another. ~~An application client may determine the current power condition of a logical unit by issuing a REQUEST SENSE command (see 6.27).~~ The REQUEST SENSE command (see 6.27) indicates if a logical unit is in the idle power condition or the standby power condition

Command standards (see 3.1.17) may define, for their peripheral device types, additional power conditions (e.g., the stopped power condition defined by SBC-2 for direct-access block devices) and extensions to the REQUEST SENSE command for reporting power conditions.

No power condition shall affect the supply of any power required for proper operation of the service delivery subsystem.

Logical units that contain cache memory shall write all cached data to the medium for the logical unit (e.g., as a logical unit would do in response to a SYNCHRONIZE CACHE command as described in SBC-2) prior to entering into any power condition that prevents accessing the media (e.g., before a hard drive stops its spindle motor during transition to the standby power condition).

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5.9.2 Power condition state machine

5.9.2.3 PC1:Active state

5.9.2.3.1 PC1:Active state description

While in this state, if power on initialization is not complete, then the logical unit shall complete its power on initialization.

While in this state, if power on initialization is complete, then:

a) ~~A~~The logical unit is in the active power condition (see table 39);
b) If the idle condition timer is active, then the idle condition timer is running; and
c) If the standby condition timer is active, then the standby condition timer is running.

5.9.2.4 PC2:Idle state

5.9.2.4.1 PC2:Idle state description

While in this state:

a) ~~A~~The logical unit is in the idle power condition (see table 39); and
b) the device server processes the REQUEST SENSE command as described in 6.27; and
c) If the standby condition timer is active, then the standby condition timer is running.

5.9.2.5 PC3:Standby state

5.9.2.5.1 PC3:Standby state description

While in this state ~~a~~:

a) The logical unit is in the standby power condition (see table 39); and
b) The device server processes the REQUEST SENSE command as described in 6.27.

6.27 REQUEST SENSE command

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~~If the logical unit is in a power condition other than the active power condition when a REQUEST SENSE command is received and there is no ACA condition, it shall return the sense key set to NO SENSE and the additional sense code set to one of the following:~~

~~a) LOW POWER CONDITION ON if the reason for entry into the power condition is unknown;~~
~~b) IDLE CONDITION ACTIVATED BY TIMER if the logical unit entered the idle power condition due to the idle condition timer (see 7.4.12);~~

~~c) STANDBY CONDITION ACTIVATED BY TIMER if the logical unit entered the standby power condition due to the standby condition timer (see 7.4.12);~~
~~d) IDLE CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition due to receipt of a command requiring the idle power condition while it was in the standby power condition; or~~
~~e) Another additional sense code based on requirements specified in a command standard (see 3.1.17).~~

Editor's Note 1: mentioning the ACA condition seems unnecessary

If the logical unit is in the idle power condition (see 5.9), the device server shall respond to a REQUEST SENSE command by returning parameter data containing sense data with the sense key set to NO SENSE and the additional sense code set to:

a) LOW POWER CONDITION ON if the reason for entry into the idle power condition is unknown;
b) IDLE CONDITION ACTIVATED BY TIMER if the logical unit entered the idle power condition due to the idle condition timer (see 7.4.12); and
c) IDLE CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition due to receipt of a command requiring the idle power condition while it was in the standby power condition;

and shall return GOOD status for the command.

If the logical unit is in the standby power condition, the device server shall respond to a REQUEST SENSE command by returning parameter data containing sense data with the sense key set to NO SENSE and the additional sense code set to:

a) LOW POWER CONDITION ON if the reason for entry into the standby power condition is unknown; and
b) STANDBY CONDITION ACTIVATED BY TIMER if the logical unit entered the standby power condition due to the standby condition timer (see SPC-4).

and shall return GOOD status for the command.

On completion of the command the logical unit shall return to the same power condition that was active before the REQUEST SENSE command was received. A REQUEST SENSE command shall not reset any power condition timers.

Suggested changes to SBC-3

4.15.1 START STOP UNIT and power conditions overview

The START STOP UNIT command (see 5.18) allows an application client to control the power condition of a logical unit. This method includes specifying that the logical unit transition to a power condition.

In addition to the START STOP UNIT command, the power condition of a logical unit may be controlled by the Power Condition mode page (see SPC-4). If both the START STOP UNIT command and the Power Condition mode page methods are being used to control the power condition of the same logical unit, then the power condition specified by any START STOP UNIT command shall override the Power Condition mode page's power control.

There shall be no notification to the application client that a logical unit has transitioned from one power condition to another. ~~An application client may determine the current power condition of a logical unit by issuing a REQUEST SENSE command (see SPC-4).~~ The REQUEST SENSE command (see 6.27) indicates if a logical unit is in the idle power condition or the standby power condition and may indicate if a logical unit is in the standby power condition.

~~The device server returns parameter data with the sense key set to NO SENSE and the additional sense code set to one of the following:~~

~~a) LOW POWER CONDITION ON if the reason for entry into the standby power condition or idle power condition is unknown;~~

~~b) IDLE CONDITION ACTIVATED BY TIMER if the logical unit entered the idle power condition due to the idle condition timer (see SPC-4);~~
~~c) STANDBY CONDITION ACTIVATED BY TIMER if the logical unit entered the standby power condition due to the standby condition timer (see SPC-4);~~
~~d) IDLE CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition due to a START STOP UNIT command; or~~
~~e) STANDBY CONDITION ACTIVATED BY COMMAND if the logical unit entered the standby power condition due to a START STOP UNIT command.~~

If the logical unit is in the idle power condition, the device server shall respond to a REQUEST SENSE command by returning parameter data containing sense data with the sense key set to NO SENSE and the additional sense code set to:

a) LOW POWER CONDITION ON if the reason for entry into the idle power condition is unknown;
b) IDLE CONDITION ACTIVATED BY TIMER if the logical unit entered the idle power condition due to the idle condition timer (see SPC-4); and
c) IDLE CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition due to:
   A) a START STOP UNIT command; or
   B) receipt of a command requiring the idle power condition while it was in the standby power condition;

and shall return GOOD status for the command.

Editor's Note 2: item c) B) is in the SPC-4 description but lacking in SBC-3

If the logical unit is in the standby power condition, the device server shall respond to a REQUEST SENSE command by returning parameter data containing sense data with the sense key set to NO SENSE and the additional sense code set to:

a) LOW POWER CONDITION ON if the reason for entry into the standby power condition is unknown;
b) STANDBY CONDITION ACTIVATED BY TIMER if the logical unit entered the standby power condition due to the standby condition timer (see SPC-4); and
c) STANDBY CONDITION ACTIVATED BY COMMAND if the logical unit entered the idle power condition due to a START STOP UNIT command;

and shall return GOOD status for the command.

If the logical unit is in the stopped power condition, the device server shall respond to a REQUEST SENSE command by returning parameter data containing sense data with:

a) the sense key set to NO SENSE and the additional sense code set to NO ADDITIONAL SENSE INFORMATION; or
b) the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED;

and shall return GOOD status for the command.

Editor's Note 3: item b) is new behavior

No power condition shall affect the supply of any power required for proper operation of the service delivery subsystem.

4.15.2 START STOP UNIT and power conditions state machine

4.15.2.4 SSU_PC2:Idle state

4.15.2.4.1 SSU_PC2:Idle state description

While in this state:

a) the logical unit is in the idle power condition (see SPC-4); ~~and~~
b) the device server processes the REQUEST SENSE command as described in 4.15.1; and
c) if the standby condition timer is active (see SPC-4) and not disabled (see 5.18), then the standby condition timer is running.

4.15.2.5 SSU_PC3:Standby state

4.15.2.5.1 SSU_PC3:Standby state description

While in this state:

a) the logical unit is in the standby power condition (see SPC-4); and
b) the device server processes the REQUEST SENSE command as described in 4.15.1.

4.15.2.6 SSU_PC4:Stopped state

4.15.2.6.1 SSU_PC4:Stopped state description

While in this state:

a) the logical unit is in the stopped power condition;
b) the device server is not capable of processing medium access commands. The device server shall terminate each ~~Any~~ medium access command~~s~~ or TEST UNIT READY command received while in this state ~~shall cause the device server to terminate the command~~ with CHECK CONDITION status with the sense key set to NOT READY and the additional sense code set to LOGICAL UNIT NOT READY, INITIALIZING COMMAND REQUIRED; ~~and~~
c) the device server processes the REQUEST SENSE command as described in 4.15.1; and
d) the power consumed by the SCSI target device should be less than or equal to that consumed than when the logical unit is in the SSU_PC1:Active, SSU_PC2:Idle, or SSU_PC3:Standby states.