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SMART S4 IF MS STATE UNSTABLE

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Smart S4 If MS State Unstable

Problem:

Modern standby replace legacy S3 to provide better user experience of system resume time, however it will consume more system power than legacy S3, to keep good user experience and prevent system drain the power too fast so MSFT has defined the battery life criteria for the MS support, normally the requirement is to have 6 days standby capability.

For example, with 53W battery to meet MSFT requirement the standby power consumption average around 368mW (53000mW/(6D*24H)), however the system might not sleep well in each time, sometimes might cause some driver not work properly and sometimes might cause by additional device plug in and sometimes might cause by hardware error.

Such unexpected scenario will cause high power consumption, in some case battery even drain out in few hours *(please refer to attached read data in latter page that power consumption over 8000mW per hour)*, sometimes it might just user leave office and have a dinner and get back to home then take a shower, but when user take the system out will found the system battery is drain out and need to plug AC immediately, worse case is user remain the adaptor in office due to the battery is full charge before leave.

Objectives:

1. Identify system power in MS mode
2. Come out the base line by different battery capacity
3. Get criteria what user define
4. Early entry S4 state automatically

Solution:

EC play the major role in modern standby support, it changes the power control when system entry/exit modern standby, it handles the event once trigger in modern standby, it also monitors entire system state in modern standby state. EC keep active when system in MS mode and periodically wake and check the battery status and keep update the remaining battery power, therefore EC is easy to identify how much average power is consumed in current MS state.

The first step is to come out the value to meet MSFT criteria depend on different battery capacity, EC can get the battery capacity from battery information, using 53W battery as an example that I mentioned in earlier page, that will be 368mW.

*Pcri = Bcap/(6 days*24 hour)*

Pcri = Criteria to meet 6 days standby power per hour, Bcap = Battery capacity

*368mW = 53000mW/(6*24)*

The second step is to get the valued data. We only get usable data for our stable power reference due to system need take some time to let system in stable modern standby state, normally it might take over 15 minutes, in here we monitor the sleep time over 1 hours as valuable sample.

When system start entry MS state, we can get current remaining battery capacity as entry value, get remaining battery capacity again once system exit MS state. We can get the delta of battery change and come out the power consumption average per hour.

Pcur = (R1-R2)/(H2-H1)

Pcur = Current average power per hour, Rx=Remaining power, Hx = MS entry/exit time in hour

The third step is to define what kind of power consumption we treat as unstable, it able to define by user and just need to pass that condition to EC for the base line adjust.

*Preq = Vadj*Pcri*

Preq = Requirement to trigger S4, Vadj = Base line adjust value

Once all value come out then we can have final algorithm: *If Pcur > Preq do S4*

Continue using 53W battery as example and the adjust value is 2, means trigger system sleep to S4 once current power consumption is over 736mW

*Preq = 736mW = 2 (Vadj) * 368 (Pcri)*

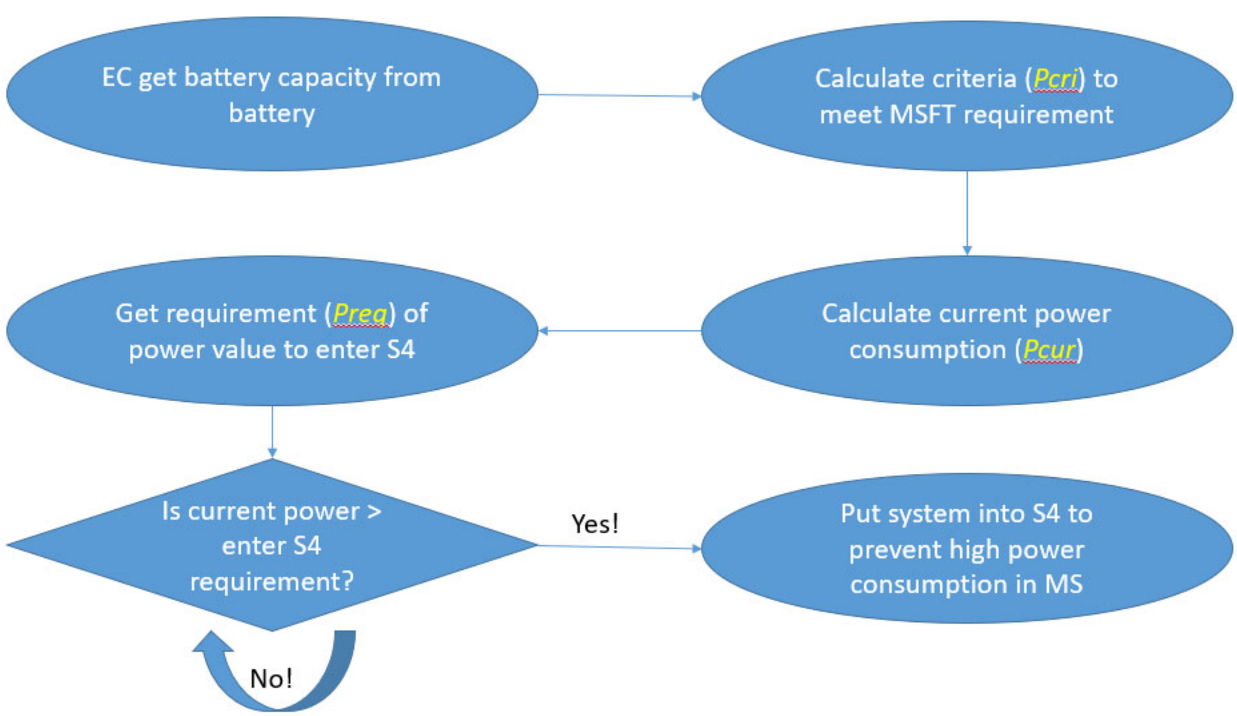
If Pcur > 736mW do S4

Real Data:

Real Sleep Study Report :

107	15:07:33	1:07:26	Sleep	93 mWh	0% of battery	82 mW	Drain	SW: 98%	HW: 98%	99%
110	16:19:05	15:31:54	Sleep	4,817 mWh	9% of battery	310 mW	Drain	SW: 99%	HW: 99%	99%
113	07:55:20	0:23:50	Sleep	138 mWh	0% of battery	347 mW	Drain	SW: 98%	HW: 98%	88%
116	08:20:12	1:45:52	Sleep	601 mWh	1% of battery	340 mW	Drain	SW: 99%	HW: 98%	88%
119	10:13:43	1:42:49	Sleep	751 mWh	1% of battery	438 mW	Drain	SW: 99%	HW: 99%	86%
122	12:00:40	1:20:17	Sleep	623 mWh	1% of battery	465 mW	Drain	SW: 99%	HW: 98%	84%
132	14:44:03	0:17:06	Sleep	196 mWh	0% of battery	687 mW	Drain	SW: 96%	HW: 95%	36%
135	15:01:21	0:44:06	Sleep	635 mWh	1% of battery	863 mW	Drain	SW: 93%	HW: 93%	36%
138	15:45:38	0:44:29	Sleep	404 mWh	1% of battery	544 mW	Drain	SW: 96%	HW: 95%	35%
143	16:35:32	0:02:38	Sleep	-	-	-	Drain	-		33%
153	10:26:16	0:00:09	Sleep	-	-	-	Drain	-		100%
156	10:26:31	2:03:49	Sleep	14,680 mWh	28% of battery	7,113 mW	Drain	SW: 87%	HW: 9%	100%
159	12:31:39	1:01:30	Sleep	8,015 mWh	15% of battery	7,818 mW	Drain	SW: 88%	HW: 9%	71%
162	13:33:54	0:01:00	Sleep	-	-	-	Drain	-		56%
165	13:52:51	1:23:26	Sleep	11,331 mWh	22% of battery	8,147 mW	Drain	SW: 83%	HW: 8%	54%

Flow Chart:



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