The Wayback Machine - http://web.archive.org/web/20200620202107/http://forum.notebookreview.com:80/threads/dellfanmanagement-dellfankeepalive-%E2%80%93…

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NotebookReview
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DellFanManagement & DellFanKeepAlive – Tools for managing the fan speed in Dell laptops

Discussion in 'Dell' started by Aaron44126, Thursday at 4:16 PM.

1.

Aaron44126 *Notebook Prophet*

Reputations:

759

Messages:
4,390

Likes Received:
1,324

Trophy Points:
231

Introducing DellFanManagement, a suite of tools for manipulating the fans in Dell laptops.

There are a few different tools in the package:

DellFanLib, a library (DellFanLib.dll) which facilitates passing fan commands to the embedded controller (EC). It uses bzh_dell_smm_io_x64.sys, and all of the other tools depend on this.
DellFanLibInterop, a .NET library (DellFanLibInterop.dll) which makes it easy to make calls to DellFanLib from a .NET environment. Other .NET developers could use this to build their own Dell fan control apps. Maybe someone can think of a different strategy that works better for certain situations.
DellFanCmd, which behaves the same as the old version of the app with the same name. A new test feature has been added which can quickly determine if it will work with your laptop model and what the available fan speeds are.
DellFanKeepAlive, a new tool which allows for locking the fans at a specific speed during certain conditions and allowing the EC to manage them during others.

The source code for the entire package is available at https://github.com/AaronKelley/DellFanManagement.
Binaries can be downloaded from https://github.com/AaronKelley/DellFanManagement/releases.

History (working backwards)

I previously released the command-line app DellFanCmd, which allows for disabling the EC fan control. DellFanCmd can also set the fan to a certain speed. Other apps like SpeedFan can also manage the fan once EC fan control is disabled. HWiNFO64 has since been updated to use the same mechanism for fan control, so it can manage the fans in the same manner without DellFanCmd or bzh_dell_smm_io_x64.sys.
• Source code
• NotebookReview forum thread

DellFanCmd is derived from an app called "Dell fan utility", by 424778940z. It uses the same driver, bzh_dell_smm_io_x64.sys, which is by the same author.
• Dell fan utility source code
• bzh_dell_smm_io_x64.sys source code
• NotebookReview forum thread

bzh_dell_smm_io_x64.sys is derived from the "i8k" driver on Linux and these projects which enable the same level of fan manipulation in Dell laptops on Linux:
• https://github.com/clopez/dellfan
• https://github.com/TomFreudenberg/dell-bios-fan-control

System requirements
• 64-bit Windows support only.
• All of the tools require loading a driver, so you must be running them elevated / "as administrator".
• All of the tools require the Visual C++ 2019 redistributable. You will get some sort of DLL load error if it is not installed.
https://aka.ms/vs/16/release/vc_redist.x64.exe
• All of the tools aside from DellFanLib are .NET binaries and require Microsoft .NET Framework 4.8.
• bzh_dell_smm_io_x64.sys is signed with a valid code-signing certificate, but it is not an EV certificate. You must make a registry change, and then reboot, in order for it to be allowed to load. More details on this can be found here. You will get a driver load error if this is not done.

Code:

```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\CI\Policy]
"UpgradedSystem"=dword:00000000
```

• See list of supported systems in the post below; there are most likely other supported systems that are not on the list, almost all models released since 2011 (Intel 2nd-gen Sandy Bridge or newer) work.

Possibilities and limitations

Basically, people have discovered a few commands that can be passed to the EC that have to do with fan management.

You can disable EC fan control or enable EC fan control. EC fan control is enabled by default, whenever you boot the system. If EC fan control is disabled, the fans will no longer respond to changes in temperature or system load. *EC fan control will remain disabled until it is specifically enabled again, or you do a full shutdown of the system. The system will always start from a cold boot with EC fan control enabled, but it will not be enabled after a reboot.*

You can set the fan level for each fan to level 0 (off), level 1, or level 2. The actual speed (RPM) for level 1 and level 2 varies from system to system. I've found that level 1 is a little bit below the lowest level that the EC normally chooses to use, and level 2 is a bit below the highest level that the EC normally chooses to use. For example, in my Precision 7530, level 1 is 2100 RPM and level 2 is 4400 RPM. However, if the EC is in charge of the fans, it won't run them any lower than 2300 RPM (unless they are off) and it can push them up as high as 4800 RPM.

Basically, this means that any setup that uses these EC commands is limited to just three fan speeds: "off", "medium", and "high". if the EC is left in charge of the fans, it has five (?) different fan speeds that it will use in addition to the "off" speed, so more granular fan speed modulation is possible but you have no direct control over it.

The last thing that you can do is query the fan speed for either fan. This works whether EC fan control is enabled or not.

DellFanCmd

This is a simple command-line tool that allows for passing commands to the EC.

Code:

```
Usage: DellFanCmd [command]
Available commands:
  ec-disable            Turn EC fan control off (fan goes to manual control)
  ec-disable-nofanchg   Turn EC fan control off and don't change the fan speed
  ec-enable             Turn EC fan control on (fan goes to automatic control)
  test                  Try turning EC fan control off,
                        and record the fan RPM at different levels.
  fan1-rpm              Report RPM for fan 1
  fan2-rpm              Report RPM for fan 2
                        (RPMs are reported via status/error code)

After EC fan control is off, you may use:
  fan1-level0           Set fan 1 to level 0 (0%)
  fan1-level1           Set fan 1 to level 1 (50%)
  fan1-level2           Set fan 1 to level 2 (100%)
  fan2-level0           Set fan 2 to level 0 (0%)
  fan2-level1           Set fan 2 to level 1 (50%)
  fan2-level2           Set fan 2 to level 2 (100%)

Append "-alt" to EC disable or enable commands to attempt alternate method.
(Example: ec-disable-alt)
```

You can read more about how this works and how to use it in the DellFanCmd thread. One thing that has been added is the test function. Running "DellFanCmd test" will run through a test sequence; the program will disable EC fan control, try the fans at each of the different levels and record the RPMs, and then enable EC fan control again.

DellFanKeepAlive

Background

I basically set all of this up so that I could build this program, which is borne out of long-term frustrations that I have with the fan control in my Precision M6700 in particular.

I purchased my Precision M6700 at launch in 2012, but before that my primary system was an Inspiron 1720. This was a nice, solidly built high-spec machine (for its time)... They don't make Inspirons like that anymore. One thing that I loved about it was that it was quiet even under high load. Eventually, I needed more horsepower so I replaced it with the M6700, which was Dell's top offering for a high-spec laptop at the time. I was generally pleased with it but noticed right away that the fans were louder. Even more obnoxious was the noise that they make when starting up from the off state. Instead of gradually revving up to the lowest running speed (≈2400 RPM), they whir up to a higher speed before settling down which causes a very noticeable "fans are turning on" sound. (My sensorimotor OCD really hates this, it's quite distracting.) And the system likes to alternate between fans on and fans off on a ≈10 minute cycle if there isn't a whole lot going on.

The Precision wasn't designed to be a quiet system. It wasn't even really designed to be a personal home system, it seems like they are more for specific high-performance use cases. But it's a shame because they are an *excellent choice* for a home system for power-user types who just want a nice, solid laptop that is serviceable, upgradeable, and that can offer high performance when desired. It's not bulky like some high-end consumer systems that lean more towards the gaming space, with crazy LED lights and huge rear exhaust radiators (but the Precision is still totally usable for gaming). If Dell spent a little bit of time working on the thermal management (...and the keyboard layout, but that's another story) then they'd have something that I really couldn't complain about.

So anyway, my goal is basically to have two modes of operation that I can easily switch between. There is "regular mode", where I am just using the

system lightly, browsing the web, writing, watching videos, doing light dev work, etc. In this case the CPU is not being pushed very hard. The system should totally be able to run with the fans at a consistent, low level for an extended period of time. Then, there is "performance mode" which I will switch over to if I need extra CPU or GPU power. In this case, the fans will be allowed to ramp up. Switching between modes should be deliberate but super easy.

What is DellFanKeepAlive?

My original idea for this was, I just wanted to let the EC manage the fans normally but prevent them from ever turning off, which is where the name came from. This would at least stop the on-again off-again fan behavior, plus the annoying startup sound in my M6700, for a nice and consistent and still quiet noise coming out of the fans. This is done by continuously watching the fan speed and system temperatures. When the fan speed hits the lowest normal EC fan speed, and the temperatures are pretty low, EC fan control will be shut off and the fans will be locked at their lowest normal speed. If the system comes under load and things start heating up, EC fan control will be re-enabled so that the fans can ramp up.

Setup

Technically, you don't need to set up two modes of operation to use this app ("regular"/"performance" as described above), so this section can be skipped. However, I have found that if you do not take some measure to limit the CPU speed, a light load can cause the temperatures to spike up quickly which will create more fan speed variation than desired or necessary. So, here is an easy way to set up two different performance modes that can be easily toggled between, on more recent versions of Windows 10.

1. Use the Balanced power plan. (This is the default and you sort of have to go out of your way to change it.)
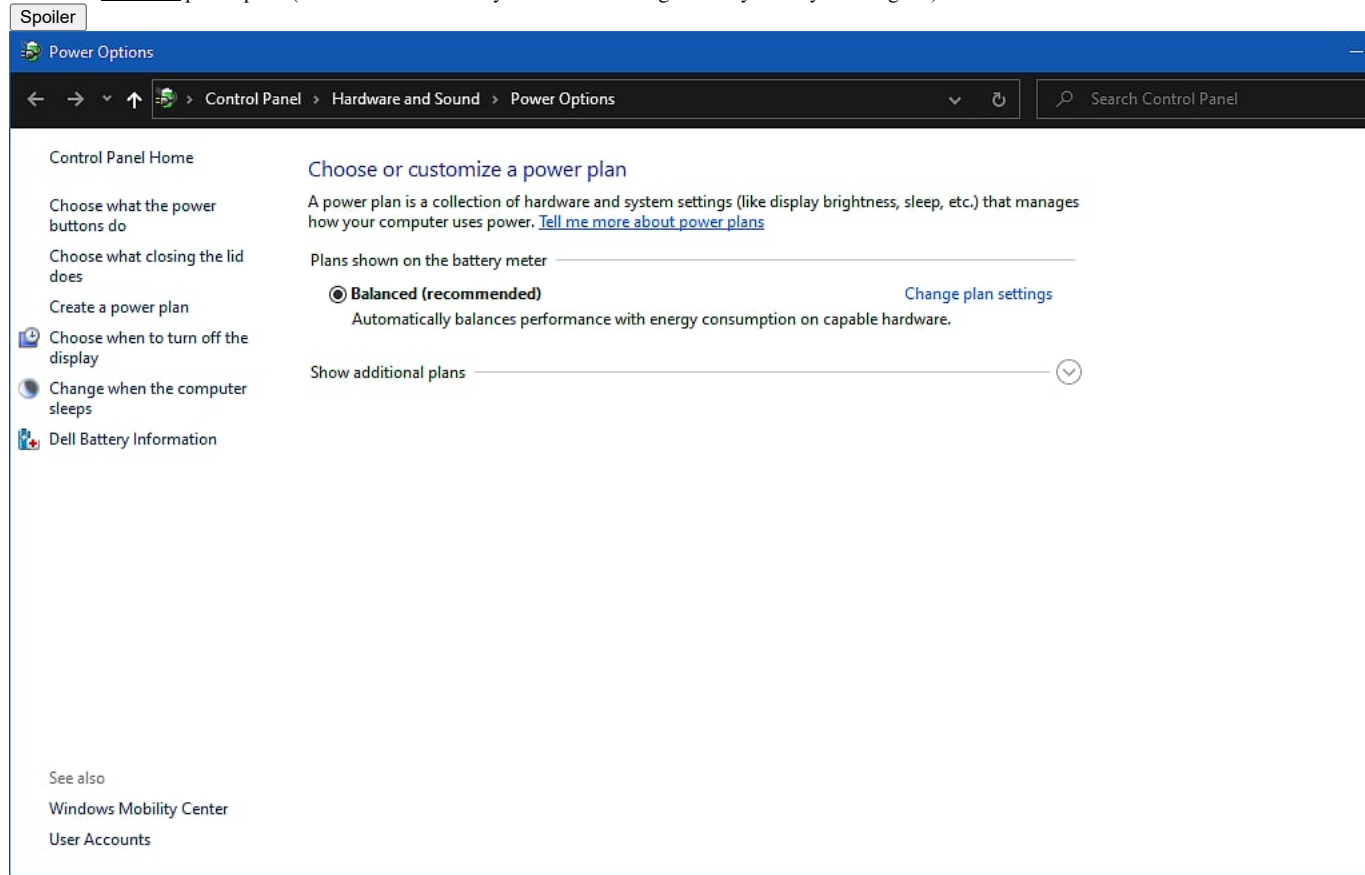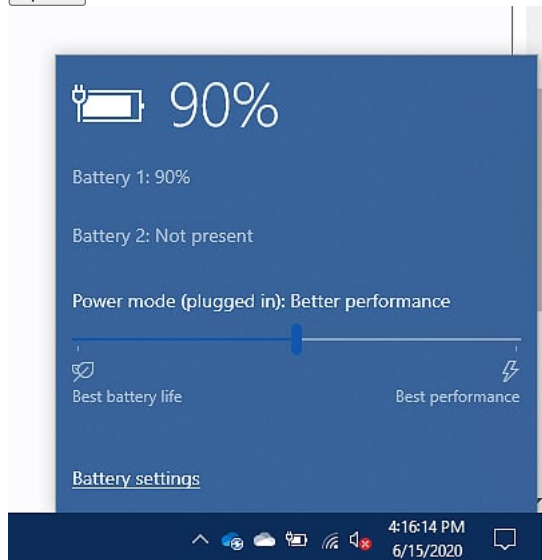
Spoiler

2. In advanced power settings, set the maximum processor state to 99%.

Spoiler
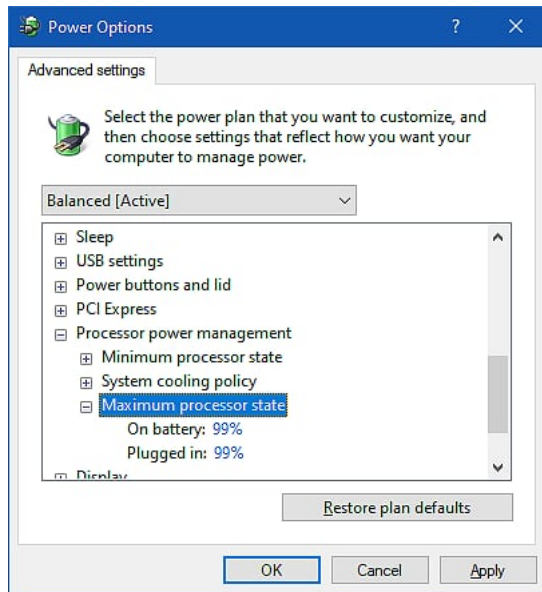
3. Set the power slider one step from the right. (You will have to make this change separately on AC power and battery power, as the system "remembers" the slider position separately for each.) This, combined with the previous step, will prevent the CPU from entering "turbo boost" speeds and you'll be capped in the mid 2 GHz range — which is completely fine for more light desktop work.

Spoiler

4. If you want to uncap the CPU speed for higher performance, all you need to do is move the slider over to the right.

Spoiler
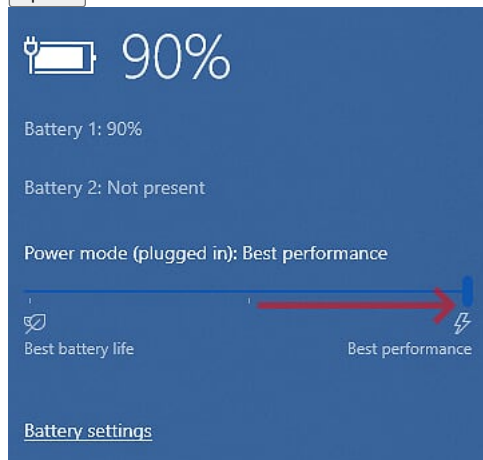
Alternate method.

Spoiler

(This is actually what I am using.)

You can leave the power slider one notch from the right and, instead, switch between the "Balanced" power profile and the "High performance" power profile, either programmatically or with a script. "Balanced" should have the maximum processor state set to 99%, and "High performance" should have the maximum power state set to 100%, so switching to "High performance" will uncap the CPU.

Benefits to this method:
• You can have other differences between "regular mode" and "performance mode" aside from the CPU speed cap.
• For example, the Precision M6700 supports the "Dell Feature Enhancement Pack" application which adds some extra thermal management options to advanced power settings. I'm using the "Quiet" thermal mode in the "balanced" profile, and "Standard" in "high performance".
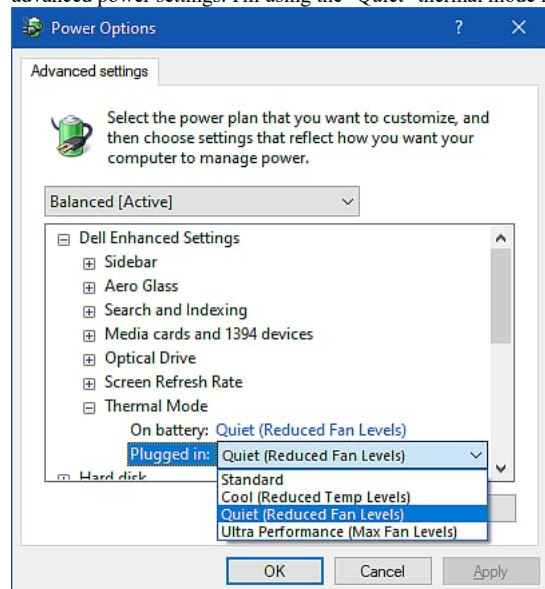
• I don't know of a way to use a script to change the power slider, but you can use a script to change the power profile. Here are commands to switch to "balanced" and "high performance", respectively.
Code:

```
powercfg -s 381b4222-f694-41f0-9685-ff5bb260df2e
powercfg -s 8c5e7fda-e8bf-4a96-9a85-a6e23a8c635c
```

(I'm using another tool to automatically change profiles when certain programs are open, so I rarely have to manually flip power modes at all.)

Using DellFanKeepAlive

The program takes three command-line parameters.
1. Lower temperature threshold (°C)
2. Upper temperature threshold (°C)
3. Fan speed threshold (RPM)

When you run the program, it will stay active and monitor the temperature (all CPU cores, and the discrete GPU as well if you have one) and the fan speeds. It will wait until all of the temperatures are below the lower temperature threshold and all of the fan speeds are below the fan speed threshold (but above zero), and at that point, it will shut off the EC fan control, locking the fan speed.

If any of the temperatures rise above the upper temperature threshold, EC fan control will be enabled and the EC can cool the system according to however it normally works.

The goal here is...
• The fans will never totally spin down because the program will lock the fan speed before the EC gets around to shutting them off.
• The fan speed will remain constant under moderate CPU load; only if one of the CPU core temperatures rises above the upper threshold will they be allowed to ramp up.

If you set the lower temperature threshold too low, the system might decide to shut off the fans before the temperature gets low enough.
If you set the upper temperature threshold too high, then it might take a while for the upper threshold to be reached and the fans to activate (and they will roar to life when they do).
If you set the two temperatures too close together, then you might end up with flip-flop behavior as the temperature waffles above and below the thresholds.

It takes some trial and error to find a good setup and it depends for each system. But really... You just want to set the upper threshold to the temperature at which you want the fans to kick up and the lower threshold comfortably below that.

For my Precision M6700, I am using:
lower threshold 70 (idle temperatures can actually drop into the 50's)
upper threshold 80
fan threshold 2800

My Precision 7530 runs considerably cooler; I am using:
lower threshold 60 (idle temperatures can actually drop into the 30's)
upper threshold 70
fan threshold 2400

Here's what it looks like running my Precision M6700.

```
DellFanKeepAlive                                                        —    □    ×

DellFanKeepAlive version 2.0 • By Aaron Kelley • GPLv3 • https://github.com/AaronKelley/DellFanManagement
Dell SMM I/O driver by 424778940z • https://github.com/424778940z/bzh-windrv-dell-smm-io
Open Hardware Monitor version 0.9.5 • Copyright © 2009-2020 Michael Möller and contributors (MPL 2.0)
Icon made from Icon Fonts (http://www.onlinewebfonts.com/icon/), licensed by CC BY 3.0

Configuration: lower temperature threshold 65, upper temperature threshold 80, RPM threshold 2800

Current time: 6/10/2020 6:42:34 AM

Temperature and fan speed thresholds are met.
The fan speed has been locked since 6/9/2020 11:25:24 PM.

System temperatures:
  CPU Core #1    54 (  46 -  79 )
  CPU Core #2    54 (  45 -  77 )
  CPU Core #3    55 (  47 -  82 )
  CPU Core #4    55 (  46 -  81 )
  CPU Package    55 (  48 -  82 )
  GPU Core       34 (  33 -  53 )

Fan speeds:
  Fan #1    2483
  Fan #2    2691
```

You can see the current temperature and RPM values, and also the range of temperatures that have been observed since the program started. (Temperatures are provided by Open Hardware Monitor.) In addition to text stating that the fan speed is locked, you can tell that this is the case because of the blue background.

Here is what things look like after some light gaming... The CPU temperature was pushed above 80, so the fan speed was unlocked (EC takes control), and the background turns red to make it obvious that this happened.

Spoiler

```
DellFanKeepAlive                                                        —    □    ×

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Dell SMM I/O driver by 424778940z • https://github.com/424778940z/bzh-windrv-dell-smm-io
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Configuration: lower temperature threshold 65, upper temperature threshold 80, RPM threshold 2800

Current time: 6/12/2020 11:17:01 PM

Temperature and fan speed thresholds are not met.
The EC has had control of the system fans since 6/12/2020 10:21:31 PM.

System temperatures:
  CPU Core #1    72 (  46 -  80 )
  CPU Core #2    70 (  45 -  79 )
  CPU Core #3    76 (  47 -  83 )
  CPU Core #4    77 (  46 -  83 )
  CPU Package    77 (  48 -  83 )
  GPU Core       38 (  32 -  56 )

Fan speeds:
  Fan #1    3015
  Fan #2    3168
```

On my Precision 7530, there are more cores to show (and lower temperatures).

Spoiler

```
DellFanKeepAlive                                                    —    □    ✕

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Open Hardware Monitor version 0.9.5 • Copyright © 2009-2020 Michael Möller and contributors (MPL 2.0)
Icon made from Icon Fonts (http://www.onlinewebfonts.com/icon/), licensed by CC BY 3.0

Configuration: lower temperature threshold 55, upper temperature threshold 68, RPM threshold 2400

Current time: 6/10/2020 7:54:36 AM

Temperature and fan speed thresholds are met.
The fan speed has been locked since 6/9/2020 4:45:18 PM.

System temperatures:
  CPU Core #1    40  (  36 -  63 )
  CPU Core #2    41  (  36 -  64 )
  CPU Core #3    41  (  37 -  64 )
  CPU Core #4    41  (  36 -  66 )
  CPU Core #5    40  (  36 -  65 )
  CPU Core #6    40  (  35 -  63 )
  CPU Package    41  (  37 -  66 )
  GPU Core       36  (  33 -  51 )

Fan speeds:
  Fan #1    2279
  Fan #2    2275
```

This happens sometimes immediately after starting the program... The EC has turned the fans off, so we have to wait for it to decide to turn them back on before the fan speed will be locked.

Spoiler

```
DellFanKeepAlive                                                    —    □    ✕

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Configuration: lower temperature threshold 55, upper temperature threshold 68, RPM threshold 2400

Current time: 6/10/2020 7:55:38 AM

Temperature and fan speed thresholds are not met.
The EC has had control of the system fans since 6/10/2020 7:55:16 AM.

System temperatures:
  CPU Core #1    42  (  41 -  50 )
  CPU Core #2    43  (  42 -  46 )
  CPU Core #3    42  (  42 -  46 )
  CPU Core #4    41  (  41 -  46 )
  CPU Core #5    42  (  41 -  49 )
  CPU Core #6    42  (  41 -  46 )
  CPU Package    43  (  43 -  49 )
  GPU Core       38  (  37 -  38 )

Fan speeds:
  Fan #1       0
  Fan #2       0
```

I think that the EC might use CPU load in addition to temperature to decide what speed to run the fans at. Here, the temperature rose so the fan speed was unlocked, but the temperature is now stable at around 50. I don't think that there is any reason for the fans to be running at 4000 RPM... But I'm going to let the EC do its thing. We have to wait for the EC to the speed before it will be locked again.

Spoiler

```
DellFanKeepAlive                                                    ─    □    ✕

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Dell SMM I/O driver by 424778940z • https://github.com/424778940z/bzh-windrv-dell-smm-io
Icon made from Icon Fonts (http://www.onlinewebfonts.com/icon/), licensed by CC BY 3.0

Configuration: lower temperature threshold 55, upper temperature threshold 68, RPM threshold 2400

Current time: 6/9/2020 3:06:09 PM

Temperature and fan speed thresholds are not met.
The EC has had control of the system fans since 6/9/2020 2:57:44 PM.

System temperatures:
  CPU Core #1     51 (  50 -  58 )
  CPU Core #2     52 (  51 -  59 )
  CPU Core #3     52 (  50 -  59 )
  CPU Core #4     55 (  50 -  60 )
  CPU Core #5     54 (  50 -  60 )
  CPU Core #6     52 (  50 -  60 )
  CPU Package     55 (  51 -  60 )
  GPU Core        44 (  44 -  45 )

Fan speeds:
  Fan #1    3900
  Fan #2    3912
```

This one is on an Inspiron 15R 5520. The program correctly detects that this system only has one fan.

Spoiler

```
DellFanKeepAlive                                                    ─    □    ✕

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Icon made from Icon Fonts (http://www.onlinewebfonts.com/icon/), licensed by CC BY 3.0

Configuration: lower temperature threshold 65, upper temperature threshold 80, RPM threshold 3200

Current time: 6/9/2020 9:14:43 AM

Temperature and fan speed thresholds are not met.
The EC has had control of the system fans since 6/9/2020 9:13:53 AM.

System temperatures:
  CPU Core #1     63 (  58 -  72 )
  CPU Core #2     60 (  57 -  72 )
  CPU Package     63 (  59 -  72 )

Fan speeds:
  Fan #1       0
```

Startup

There are any number of ways to start the program at boot. I'm using Task Scheduler with an "At log on" trigger that just fires up the program. In this case you have to make sure that the task has "Run with highest privileges" selected, again, the program must be run elevated so that it can load the EC I/O driver. The thresholds can be specified in the "Add arguments" field.

Spoiler
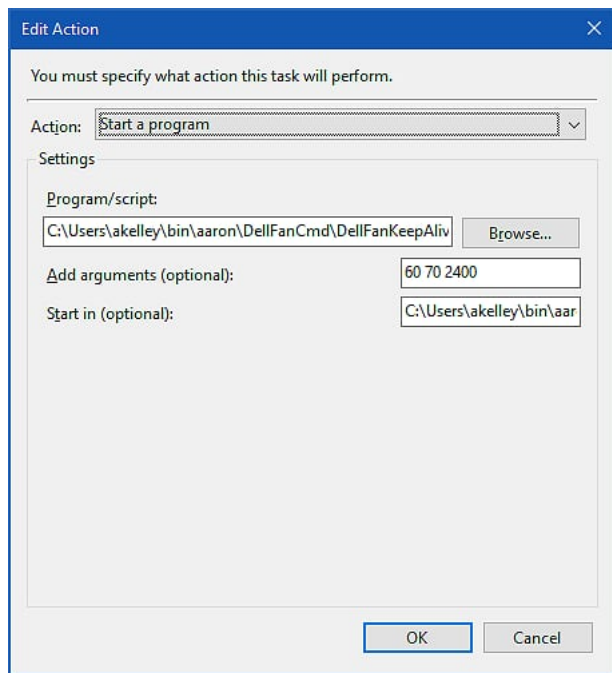
One more note... If you run DellFanCmd while DellFanKeepAlive is running, it will probably cause DellFanKeepAlive to crash. Don't run the tools at the same time.

DellFanLib and **DellFanLibInterop**

These can be used to build your own fan control solutions. They have similar interfaces; DellFanLibInterop exists just to make it easy to call DellFanLib from a .NET environment without having to set up the interop calls yourself. Check DellFanLib-Public.h and DellFanLib.cs to see the interface, or look at the DellFanCmd source code which is a pretty straight-forward command-line implementation.

Always interested in ideas for improvement, or if anyone has ideas for other strategies (within the constraints of what is possible with the limited EC control) that might work better. I'll be updating this post over the next week or two to flesh out some bits of information, but I wanted to go ahead and get this out there for people to try.

Last edited: Thursday at 5:02 PM
Aaron44126, Thursday at 4:16 PM
#1
alexhawker likes this.

2.

Aaron44126 *Notebook Prophet*

Reputations:

Messages:
4,390

Likes Received:
1,324

Trophy Points:
231

Supported systems:
Spoiler
We have confirmation that this method works with these systems. (Add yours in a comment below and I will add it to this list.) I think that it is highly likely to work with any system closely related to these (basically any system with a 2nd-generation Sandy Bridge CPU, or later).

Precision M4600 / Precision M6600
Precision M4700 / Precision M6700
Precision 7530 / Precision 7730

Precision 5520

Latitude E6540
Latitude E7440

759

Inspiron 5379
Inspiron 5577
Inspiron 15R 5520
Inspiron 15R 5521

Inspiron 7559
Inspiron 7567
Inspiron 7577

Inspiron 7779 ("2-in-1")

G5 5587
G7 7588

XPS 9360
XPS 9550
XPS 9560
XPS 9570 ([BIOS 1.6.0 or lower?](#))
Note: Some XPS systems seem to lose the ability to control the screen brightness from the keyboard after disabling EC fan control

How to check to see if your system supports this fan control mechanism.

1. Make sure that Visual C++ 2019 redistributable and .NET Framework 4.8 are installed.
https://aka.ms/vs/16/release/vc_redist.x64.exe
https://dotnet.microsoft.com/download/dotnet-framework/thank-you/net48-web-installer

2. Apply the registry change to allow non-EV-signed drivers to be loaded.
Code:

```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\CI\Policy]
"UpgradedSystem"=dword:00000000
```

Reboot.
(You can remove this after the test to restore things to how they used to be.)

3. Download DellFanCmd and unzip.
https://github.com/AaronKelley/DellFanManagement/releases

4. Open a command prompt "as administrator" in the location where you unzipped the files.

5. Run the command:
Code:

```
DellFanCmd test
```

6. The system should cycle through some different fan speeds and come back with the RPM values... Post back with the results.

Last edited: Thursday at 4:59 PM
Aaron44126, Thursday at 4:47 PM
#2
alexhawker likes this.

3.

alittleteapot *Notebook Guru*

Reputations:

Messages:
63

Likes Received:
29

Trophy Points:
26

Hi Aaron!

I thought I would post the results here. Ambient temperature is around 77 F, and this is my Precision 7730 under idle load:

Fan 1 initial speed: 3389
Fan 2 initial speed: 3584

Fan 1 level 0 speed: 0
Fan 1 level 1 speed: 2018
Fan 1 level 2 speed: 4192

12

Fan 2 level 0 speed: 0
Fan 2 level 1 speed: 2005
Fan 2 level 2 speed: 4201

alittleteapot, Thursday at 5:14 PM
#3
Aaron44126 likes this.

4.

Aaron44126 *Notebook Prophet*

Reputations:

Messages:
4,390

759

Likes Received:
1,324

Trophy Points:
231

> alittleteapot said: ↑
>
> > I thought I would post the results here.
> > Click to expand...

Thanks. That's about the same as I see on the Precision 7530. I haven't had confirmation that any newer systems are supported (Precision 7X40, 7X50)... hoping that nothing has changed.

Aaron44126, Thursday at 9:07 PM
#4

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