**A REPORT**

**ON**

**THERMAL AWARE ADAPTIVE GOVERNOR**

**BY**

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**ABSTRACT**

In most of the cases, the DVFS (Dynamic Voltage and Frequency Scaling) algorithm which is the CPU governor is set once. The algorithm is not dependent on the thermal state of the CPU/systems. The proposal here is to have an adaptive governor based on the thermal state. Once the CPU/system threshold is hit and mitigation needs to be done, the governor needs to adapt itself to a powersave biased governor. Until the threshold is not hit, the governor will follow performance biased governor.

**PROBLEM STATEMENT**

Our main problem is to control the temperature of the CPU/systems. So, we are trying to do that by controlling the clock frequency. The relation between the two is well defined below:

Power drawn (i.e. heat generated) is determined by CPU utilization. In a digital, synchronous CMOS circuit (such as your processor), the power consumption is computed by:

**P = C x V^2 x f**

Where C is the capacitance of the digital circuit (changes based on what instructions are being executed), V is the voltage of the CPU, and f is the clock frequency. Some instructions draw more power than others, so we will assume it is fixed here. So, basically the temperature of CPU/systems depends on the power consumption. In order to reduce the temperature, one fine way is to decrease the clock frequency as it is directly proportional to the power consumption.

When the clock frequency is high, a certain program is executed fast i.e. less time is required. But due to high frequency CPU utilization is also high which leads to rising of the CPU/system temperature. So, when we lower the clock frequency the same program is executed in a longer time period, thereby reducing the power consumption and CPU utilization is also reduced, thus temperature is lowered.

To resolve this problem, we can implement a governor which changes the clock frequency to minimum (i.e. powersave) when threshold temperature in hit, otherwise it will follow the default maximum frequency (i.e. performance)

**PROJECT DESCRIPTION:**

**OVERVIEW**

The working of the governor after it has been set as the primary CPU frequency governor can be summarized as:

1. Continuous monitoring of the temperature.
2. Changing the CPU frequency when its required.
3. Terminating the temperature monitoring thread after some other governor is set.

**BLOCK DIAGRAM**

Temperature

Monitoring

Thread/Loop

Governor

Set

CPU frequency driver

End Thread

CPU frequency changed according to Temperature

Checks if Current Governor Changed

Check

Temperature

N

yes

**IMPLEMENTATION**

* Created a function in the thermal\_core.c file which will return the temperature of the sensor according to its sensor ID.
* Whenever **this** governor is set CPU frequency driver will call this governor for each CPU core.
* Created a function in the governor’s file which will create temperature monitoring thread which will run continuously.
* In the temperature monitoring thread, a function will check whether the current governor is changed.

1. If it is changed then the thread will be terminated.
2. Else the thread will continue.

* In the temperature monitoring thread, a function in thermal\_core.c will bring the temperature and according to this temperature frequency will be set. If the temperature is below the threshold temperature, frequency will be set to the maximum otherwise set to the minimum frequency.

**PREREQUISITES**

* Implementation of a simple character driver and how “cat” and “echo” are working.
* Building a kernel for testing.
* Knowledge of the code flow of the CPU frequency drivers and Thermal drivers.
* Implementing a thread in C.

**CONCLUSION**

Pertaining to the above project work, we conclude that we have successfully implemented a new governor which is thermally aware. Such a governor will save systems from any thermal damage.