

Frequency scaling & turbo

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CPU frequency

- ▶ CPU frequency sets the pace at which instructions are executed by the CPU

- ▶ A higher frequency results in
 - Higher power
 - Higher energy usage
 - Possible higher performance

Application performance

- ▶ Different parts of application performance can be limited by
 - Memory bandwidth
 - CPU frequency

- ▶ If your overall application performance is mainly limited by memory bandwidth, the CPU frequency has little impact on the application performance

Turbo mode

- ▶ Each CPU has a base frequency, which is the frequency that the CPU is guaranteed to work at.
- ▶ Turbo mode means that the CPU increases the frequency above the base frequency, if temperature allows.
 - Higher frequency results in more heat dissipation and a higher temperature.

Modifying the CPU frequency

- ▶ By default, the nodes use turbo mode
- ▶ CPU frequency can be modified by the user through a SLURM setting
 - #SBATCH --cpu-freq=2100000
 - Set a CPU frequency of 2.1 GHz
- ▶ Available frequencies: 1 GHz - 2.3 GHz (in steps of 0.1 GHz)
 - --cpu-freq=2301000 represents turbo mode
- ▶ The user can only lower the CPU frequency, as default turbo mode is used.

Why to use a lower frequency?

- ▶ Running at different frequencies
 - tells you if your application is mainly memory bound or CPU bound
- ▶ If your application is memory-bound,
 - a lower frequency will not impact performance, but
 - it will save some energy.
- ▶ The base frequency is a guaranteed frequency,
 - so your application performance does not depend on the current temperature of your allocated CPUs.
 - Application performance should be more reliable

Thanks for your attention

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