Frequency scaling & turbo

2020

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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

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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

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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.

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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.

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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 me more reliable

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Thanks for your attention

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