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Updating Energy Model from Thermal

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Agenda

- Description of the issue

- Proposed idea

- Details about possible design

- Q&A

Description of the issue

- CPU's Total Power = Static Power + Dynamic Power
- CPU's power can increase with the temperature
  - Static power (a.k.a. leakage) is sensitive to the temperature
- Some models show that leakage can double every 20degC
- The SoC's silicon temperature can be increased by some "big device", e.g.
  - GPU - when gaming or doing inference
  - ISP - while video recording or video call
  - AI - accelerator doing the work
- The CPU's power can change due to the other devices increased heat
  - The Energy Model can then be quite inaccurate (~20% or even up to ~40%)
  - Some types of CPUs have bigger leakage and thus be more affected
  - The decision done by Energy Aware Scheduler (EAS) can be inaccurate
  - The decisions in other algorithms in different frameworks might also be inaccurate (IPA, DTPM)
- In the past we used to have detailed power model
  - Before using Energy Model in thermal framework for cpufreq_cooling
  - There was dynamic power and static power for Intelligent Power Allocation (IPA)

Proposed idea

- Enhance thermal framework
  - Make it capable of updating Energy Models (EM) data
  - Create leakage model for new cooling devices
    - We can use polynomials to approximate this
  - Add thermal governor which will adjust EMs' power values
- Make consistent DTPM and Thermal
  - Currently DTPM uses EM in quite similar way
  - Make use DTPM and thermal each other's decisions
    - Then some power profiles are set via DTPM interface, the thermal governor should take them into account

SoC thermal zone
w/ cooling devices and temp. sensor

Big CPUs

Little CPUs

GPU
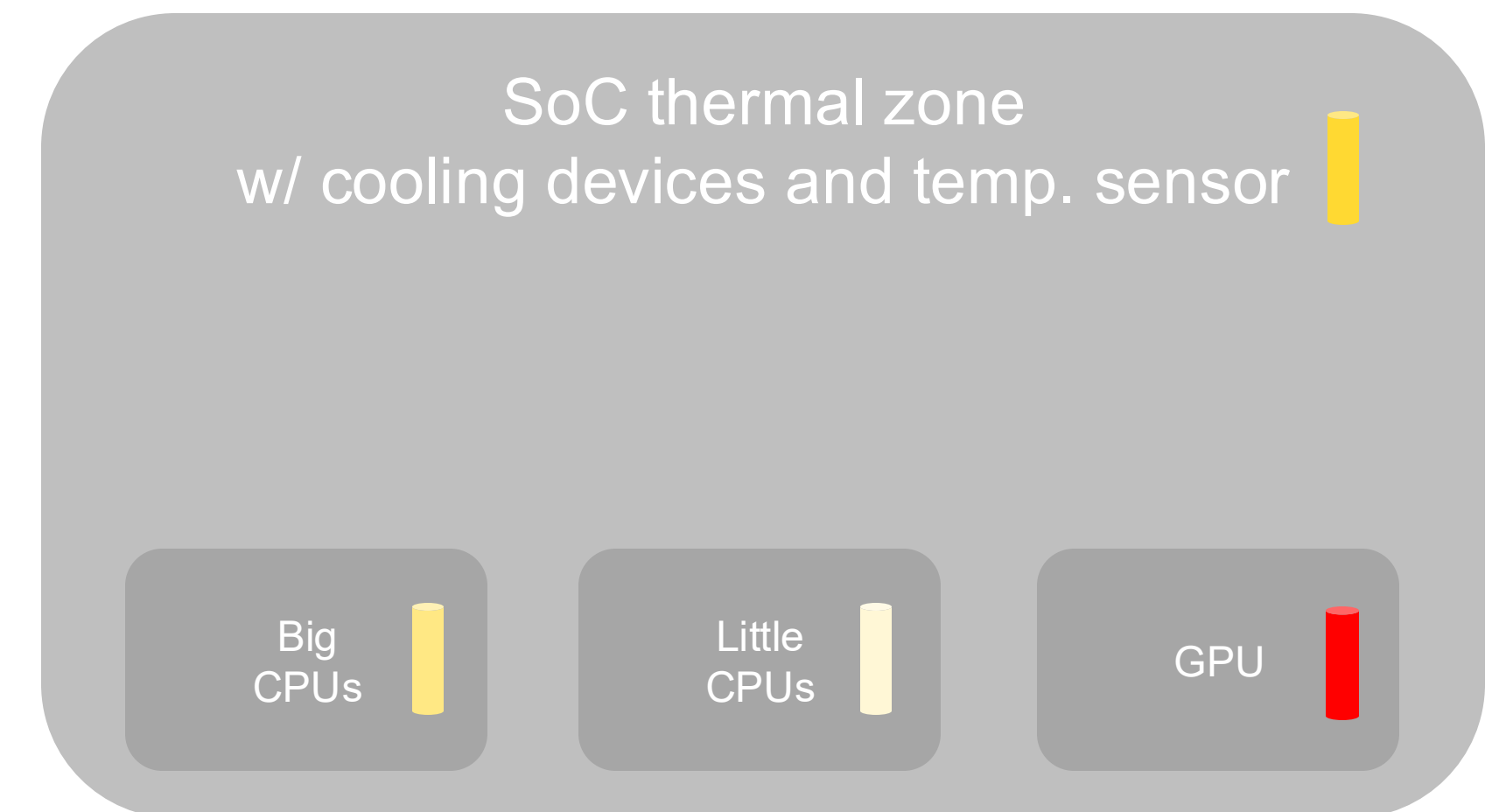
Details about possible design

- Refactor and merge cooling devices' code
  - cpufreq cooling and devfreq cooling which uses EMs
  - Thermal and DTPM devices would get one common "power_cooling" device code
- The common "power_cooling" device would be capable of updating the Energy Model
  - Create a copy of the original EMs
  - Create and update new EM based on internal thermal model
- There is a need of some new thermal governor
  - Monitoring the thermal zone with a few power_cooling devices (Big CPUs, Little CPUs, GPU, ISP)
- We would probably need information about
  - Temperature of each cooling device
  - SoC temperature
  - Utilization of each cooling device
    - to determine which device contributes the most to the SoC heat

Q&A

Thank you!