Work-in-Progress: Towards a fine-grain thermal model for uniform multi-core processors

Motivation

Rao et al. model
- Has very low complexity
- Neglects the heat transfer between neighboring cores

Matrix model
- Has low complexity
- Models only steady state temperatures

HotSpot model
- Is a fine-grain model
- Has very high complexity
- Models a high number of thermal layers
- Requires detailed information of the platform

Thermal models

Goal

To design an efficient and simple thermal model for multi-core platforms to be coupled with a large variety of existing schedulers. This model must exhibit both transient and steady temperatures at run-time.

Concluding Remarks

We provided a set of parameters, properties and a simple architectural/functional description of the hardware and software used to model the application and the platform.

Next Step

To design efficient thermal-aware task-to-core mapping and scheduling strategies together with the associated analyses to reduce the average platform temperature.

References

(11) —. “Towards thermal and cost-effective real-time systems under thermal-aware design,” in HLSRT 10, (IFIP WG 10.6), 2010.

Dual core thermal model

\[
\begin{align*}
\frac{df(t)}{dt} &= (T_1(t) - T_a(t)) \\
&= 0.000226(T_1(t) - T_a(t)) + 0.000226(T_2(t) - T_a(t)) + 0.000226(T_3(t) - T_a(t)) + 0.000226(T_4(t) - T_a(t))
\end{align*}
\]

One-dimensional Laplace transform: \( f(t) \equiv \int_0^\infty f(t) e^{-st} dt \)