Some Challenges in the Area of Thermal Issues

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Accuracy

- Convince ourselves that our models are acceptably accurate:
  - Modeling at what level of detail? (e.g., control logic blocks, clock network)
  - Take into account local, rather than average global quantitites? (e.g., voltage, leakage power)
  - How to model power delivery accurately?
  - How can we design and experiment with better sensors (IBM Power 5)?

Why? Because we are less able to use
"intuititon sanity check" to validate our conclusions

Scope

- Undestand the division of labor between microarchitecture/compiler/OS
  - Temperature variations are slow (e.g. for a power density of 1 W/mm2, T changes 0.1 degrees in about 25-100 usec)*
  - Microarchitecture responds quickly, has low overhead, but adds complication
  - Software is typically the opposite, plus it may have future knowledge

Why? In the T world, things take longer to occur than in the hardware microarchitecture world

* David Skadron, ISCA 2004 tutorial

Different Mindset

- Often key is rate of change of events rather than absolute number of events
  - DI/dt
  - Cooling rate also important
  - Jude's point
- Inderdependences between different problems:
  - Power control schemes introduce I spikes, which affects voltage

Why? We come from simpler, more static environments: increase performance