

Thermal-Aware Scheduling for Real-time Applications in Embedded Systems



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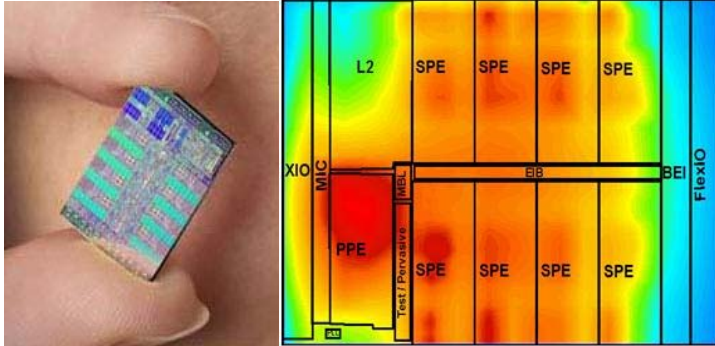
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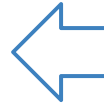
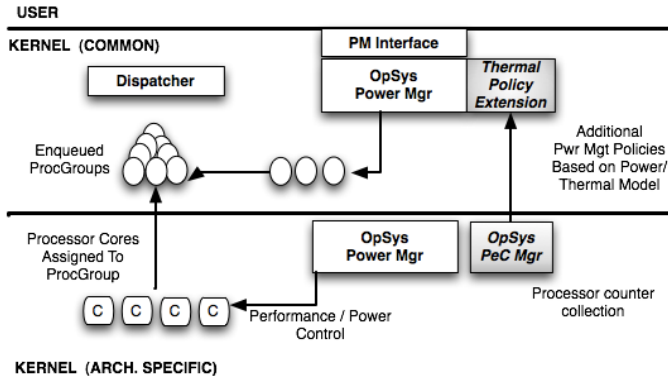
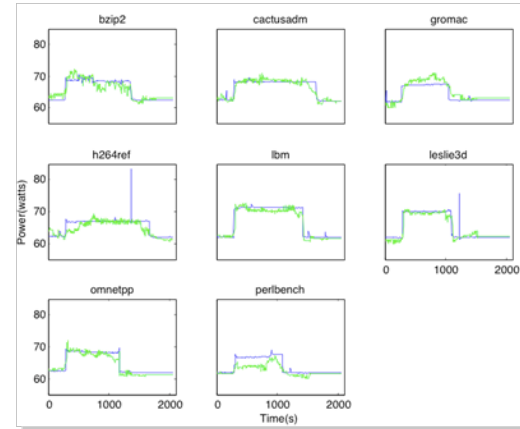
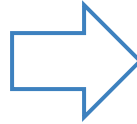
Desktop thermal mgt techniques inappropriate for embedded systems

- Use of DVFS in response to DTM events has negative impact on deadlines
- Real-time requirements eliminate available slack in task schedules

Need to **avoid** rather than **react** to thermal events

System-wide energy model

- ✓ Based on H/W performance counters
- ✓ Map system power consumption to overall thermal envelope

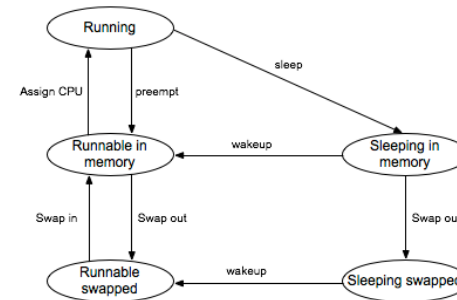
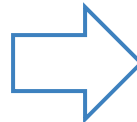


Thermal Policy Manager

- ✓ Extends existing power mgt
- ✓ Uses model to predict what threads are leading to a DTM event

OS Dispatcher

- ✓ Adjusts load balance to move work to cooler processing cores





Contributions

- ✓ Model that relates system energy input to subsystem energy consumption based on tightly correlated parameters
- ✓ Scheduler mechanisms that balance task load to confine power consumption to a given power budget and thermal envelope

Challenges

- How to create a full system power and thermal model?
- Do we have the correct set of sensors?
- Are sensors correctly placed on the processor?
- How to balance power vs. performance in scheduling decisions?