

Energy-Aware Computing Systems (EASY)

Energy-related Optimisations

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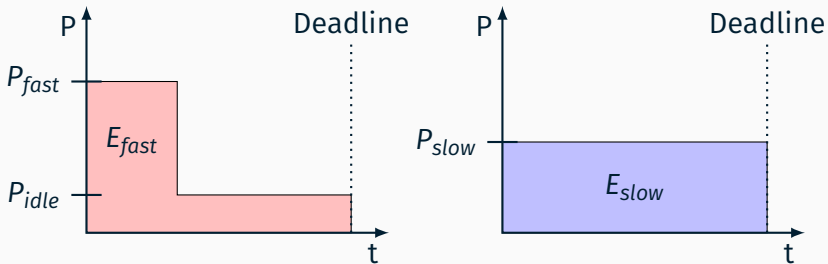
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Race-to-Sleep for Energy Optimisation

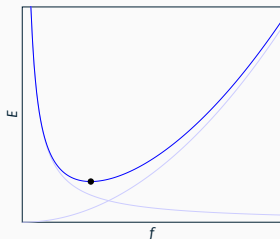


Relevant parameters

- $P_{idle}, P_{fast}, P_{slow}$
- t_{fast}, t_{idle}
- Transition latencies

Static Power and Energy Optimisation

- Energy demand: $E = Pt$
- CMOS power model: $P = \underbrace{\alpha C f V^2}_{P_{dynamic}} + \underbrace{V I_{leak}}_{P_{static}}$
- Execution time: $t \propto f^{-1}$ (?)



Neither extreme is optimal

- $f \rightarrow \infty \Rightarrow E_{dynamic} \rightarrow \infty$
- $f \rightarrow 0 \Rightarrow E_{static} \rightarrow \infty$

Typical DVFS Strategies

- Maximise performance: $f = f_{max}$
- Based on CPU utilisation:
 - If “over-utilised”, increase frequency
 - If “under-utilised”, decrease frequency
- Application-aware:
 - observed performance $\leftrightarrow$ desired performance
- Profile-based:
 - { Hardware-, Application-, User-, ... } specific data sets