Energy-Aware Computing Systems (EASY)

Energy-related Optimisations

2020-07-09

Timo Hönig, Stefan Reif, Benedict Herzog

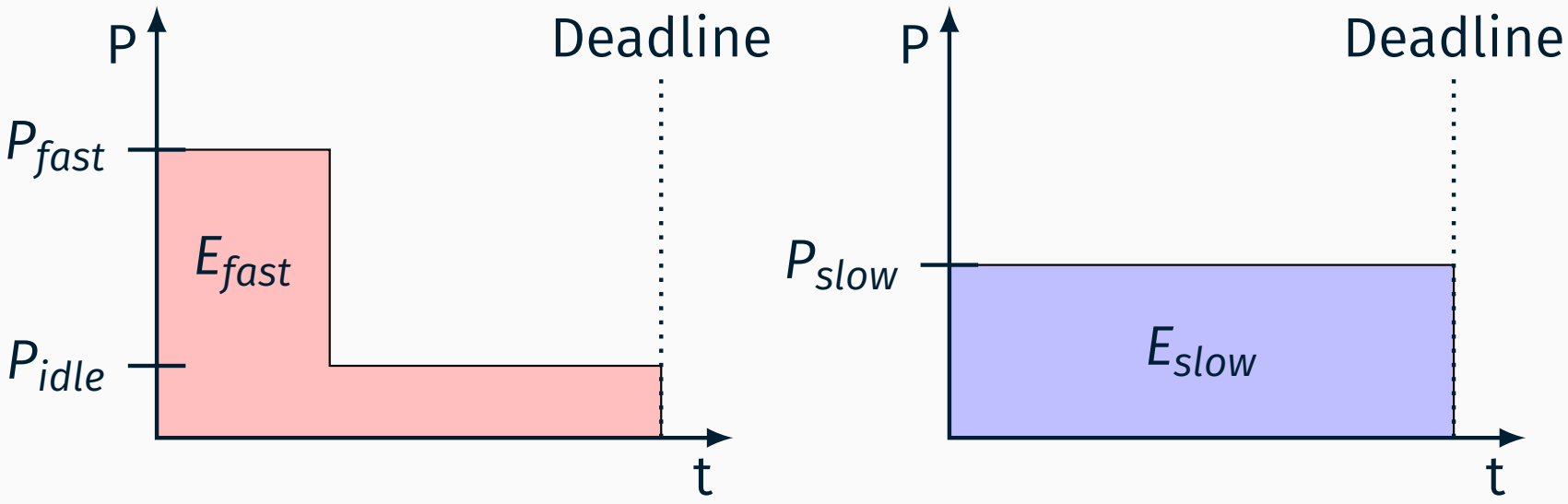
Lehrstuhl für Informatik 4
Friedrich-Alexander-Universität Erlangen-Nürnberg

Lehrstuhl für Verteilte Systeme
und Betriebssysteme

FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

TECHNISCHE FAKULTÄT

Race-to-Sleep for Energy Optimisation

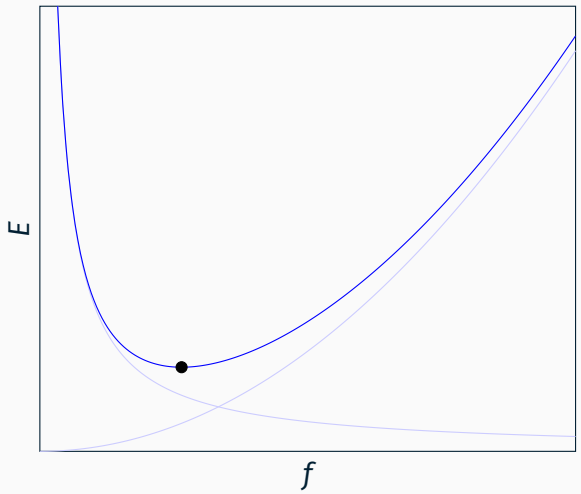


Relevant parameters

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

Static Power and Energy Optimisation

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



Neither extreme is optimal

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

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