Processor Speed Selection Minimizing Expected Energy Consumption for Real-Time Tasks

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Set of real-time jobs J_i, executed on a single unicore processor.
$J_i : (\texttt{arrival time}; \texttt{execution time} \leq C; \texttt{relative deadline} \leq \Delta)$

- $P_{ower}(S_{peed}(t))$: Active power dissipated by the processor at time t, working at speed $S_{peed}(t)$.
- $E_{nergy} = \int_0^T P_{ower}(S_{peed}(t))dt$: Energy consumption of the processor from 0 to T.

On-line energy minimization problem:

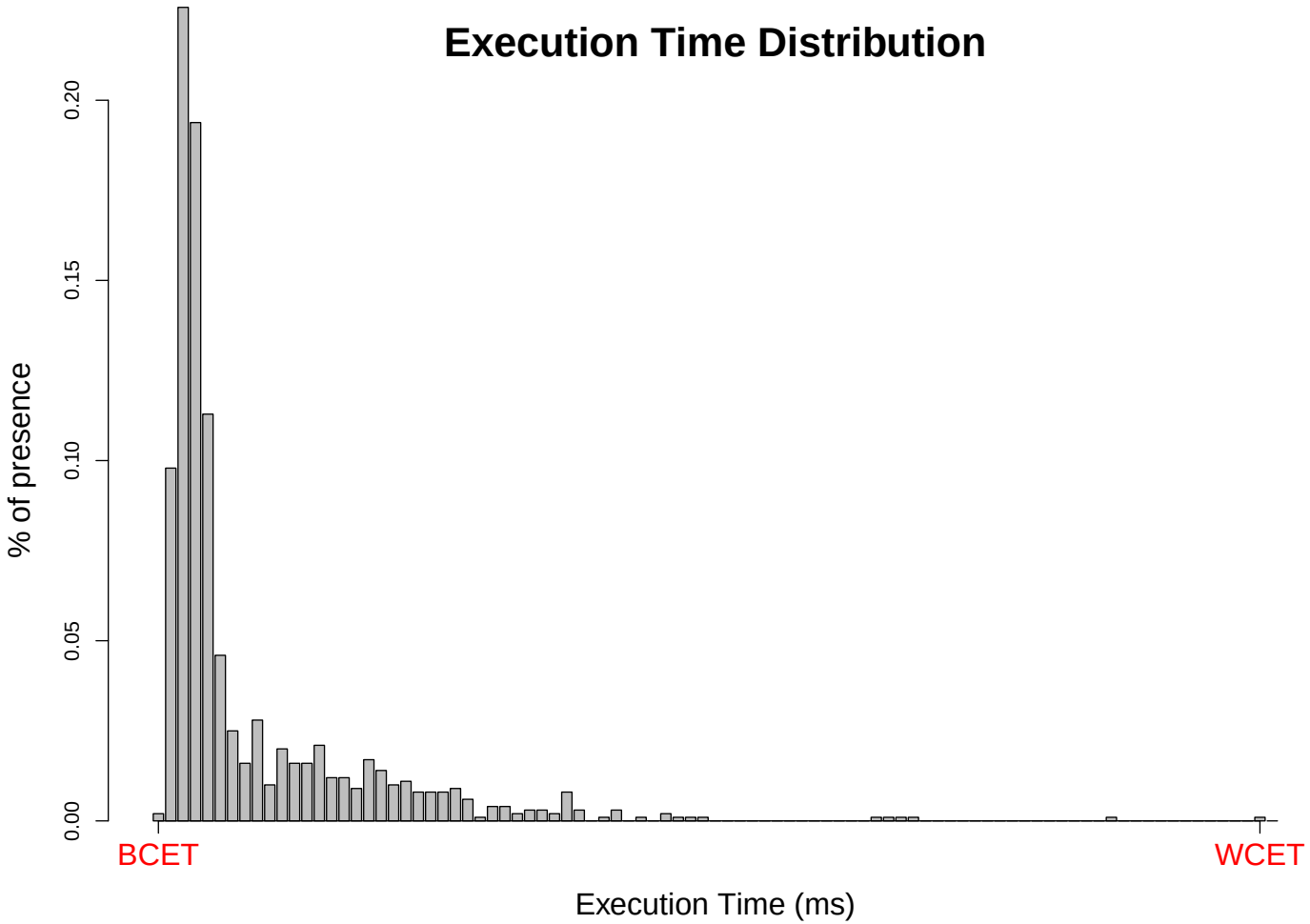
At each time t, select speeds $S_{peed}(t)$ of the processor and a scheduling policy so that:

1. All jobs are executed before their deadlines.
2. The expected energy consumption $\mathbb{E} \int_0^T P_{ower}(S_{peed}(t))dt$ is minimized.

Knowledege on Jobs

By using statistical knowledge on job arrivals, we can anticipate future job arrivals.

Here $\Rightarrow$ Statistical knowledge on job Execution Time



Solution

Markov Decision Process solution

- Use a Markov Decision Process (MDP) to compute the optimal speeds.
- Gain from 10% to 100% for the majority of the job size distributions.