

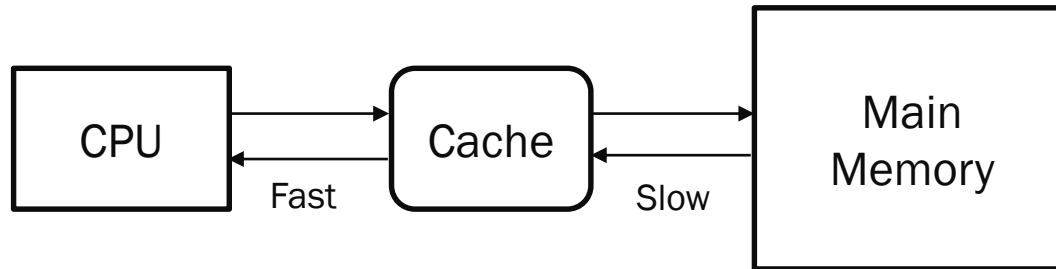


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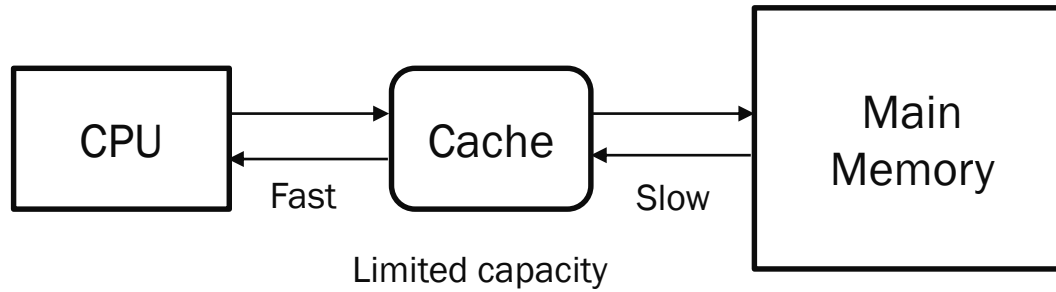
Cache Persistence Aware WCRT Analysis for FPPS

Syed Aftab Rashid, Geoffrey Nelissen and Eduardo Tovar

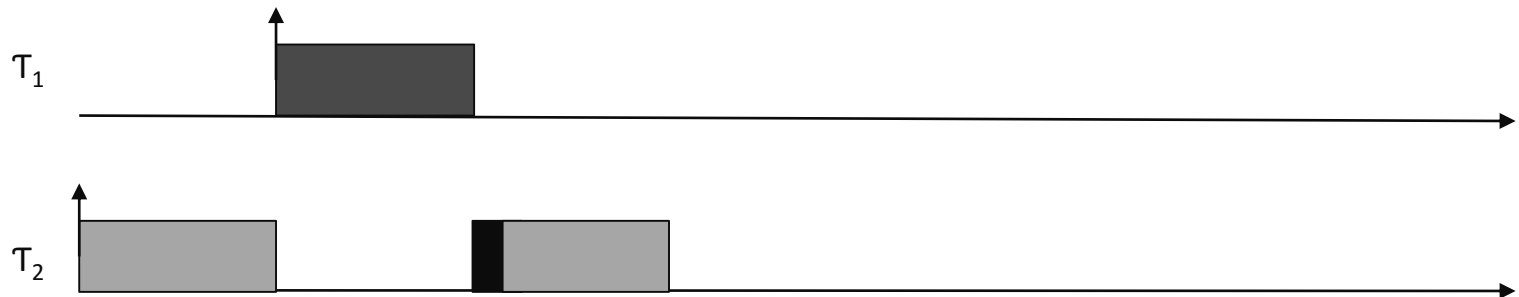
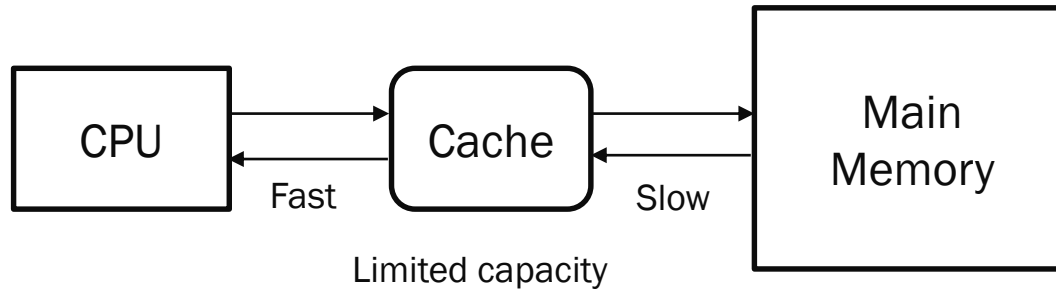
Context



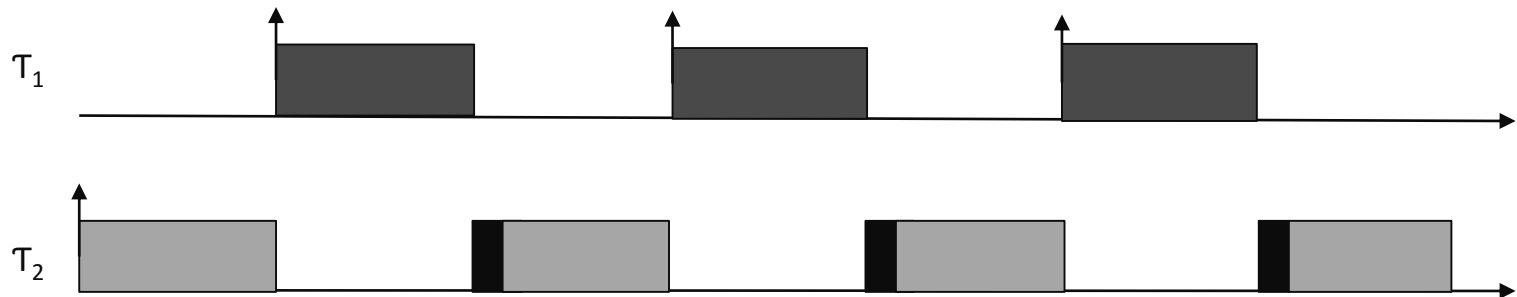
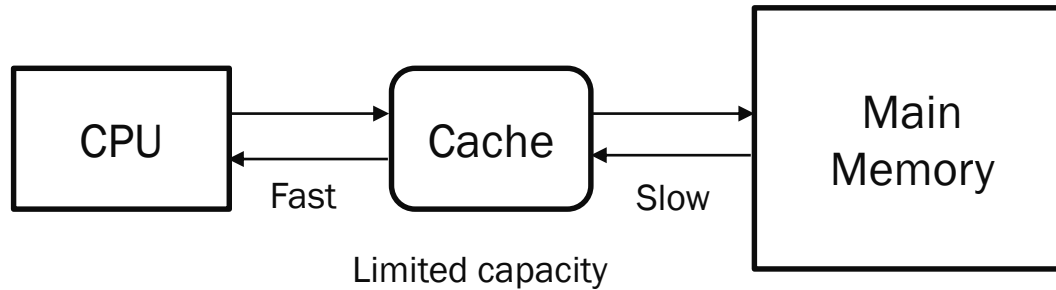
Context



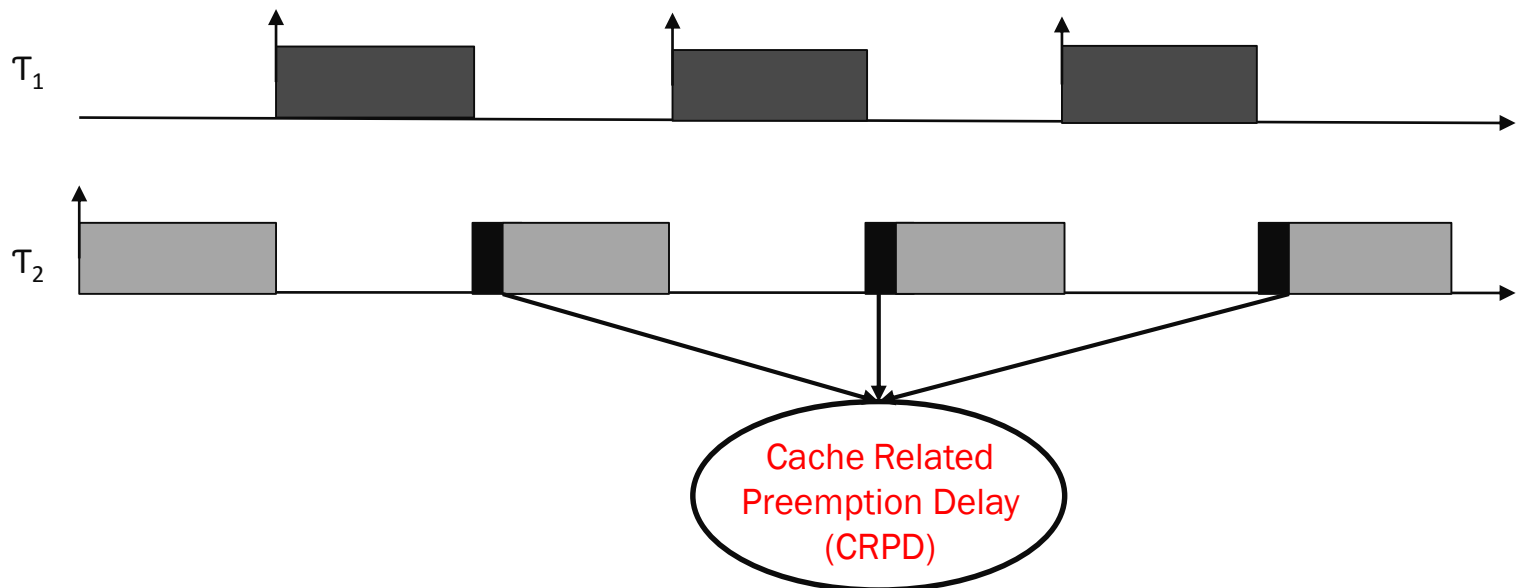
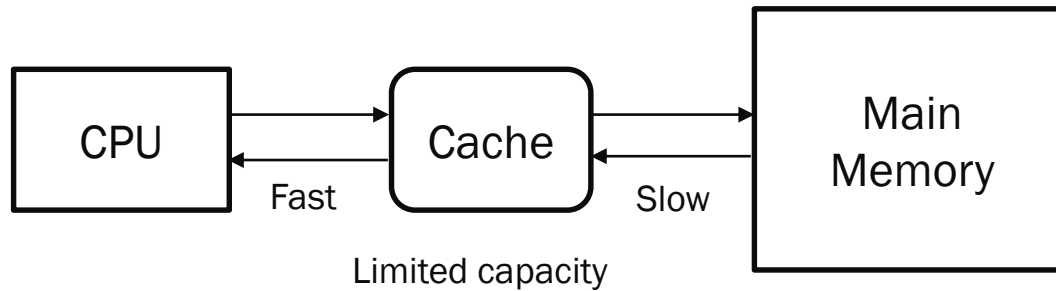
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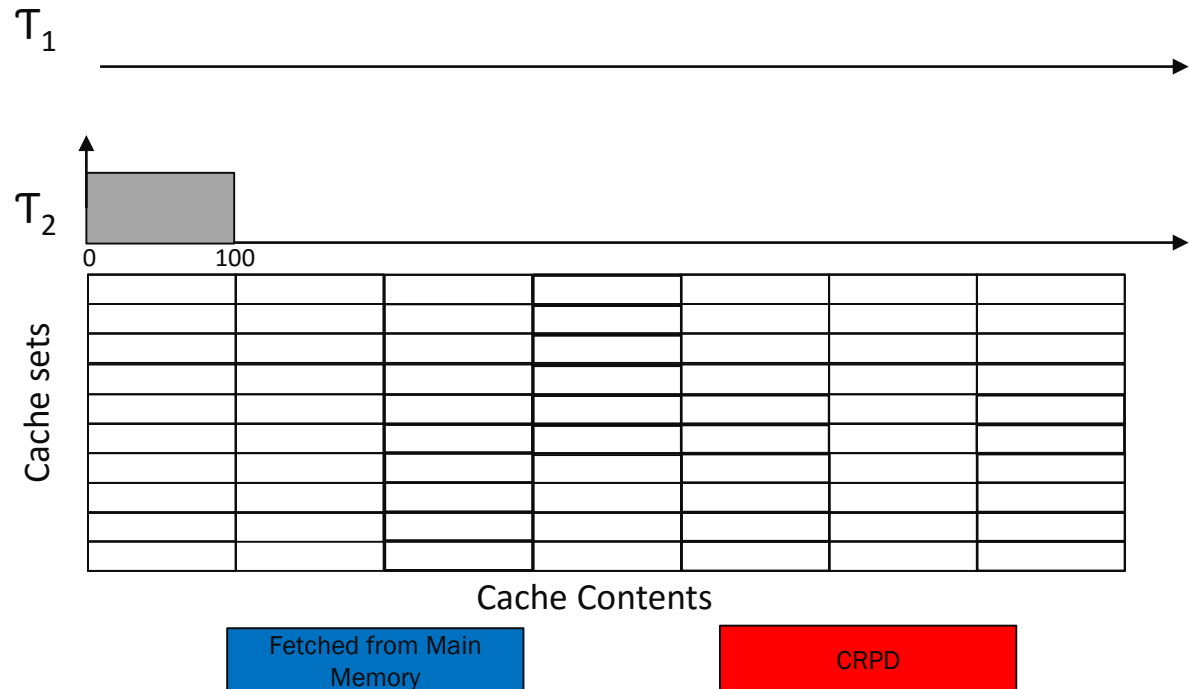
Motivational Example

- Taskset $\{T_1, T_2\}$
 $C_1 = 100$ and $T_1 = 200$
 $C_2 = 400$ and $T_2 = 1000$



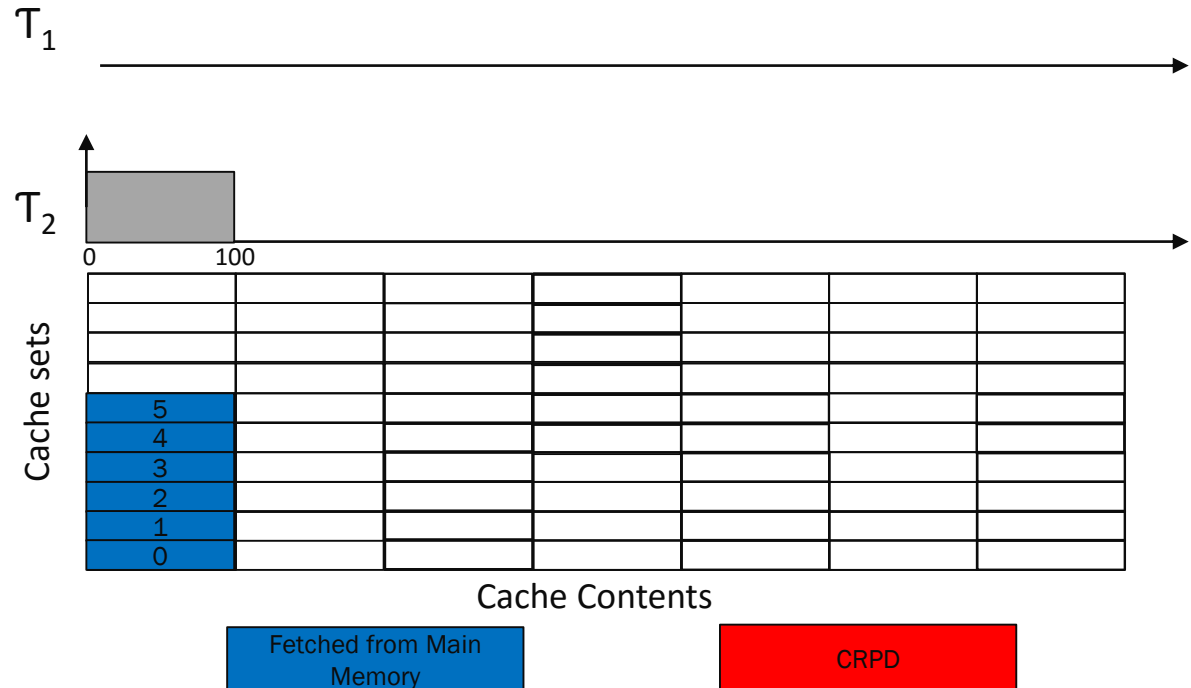
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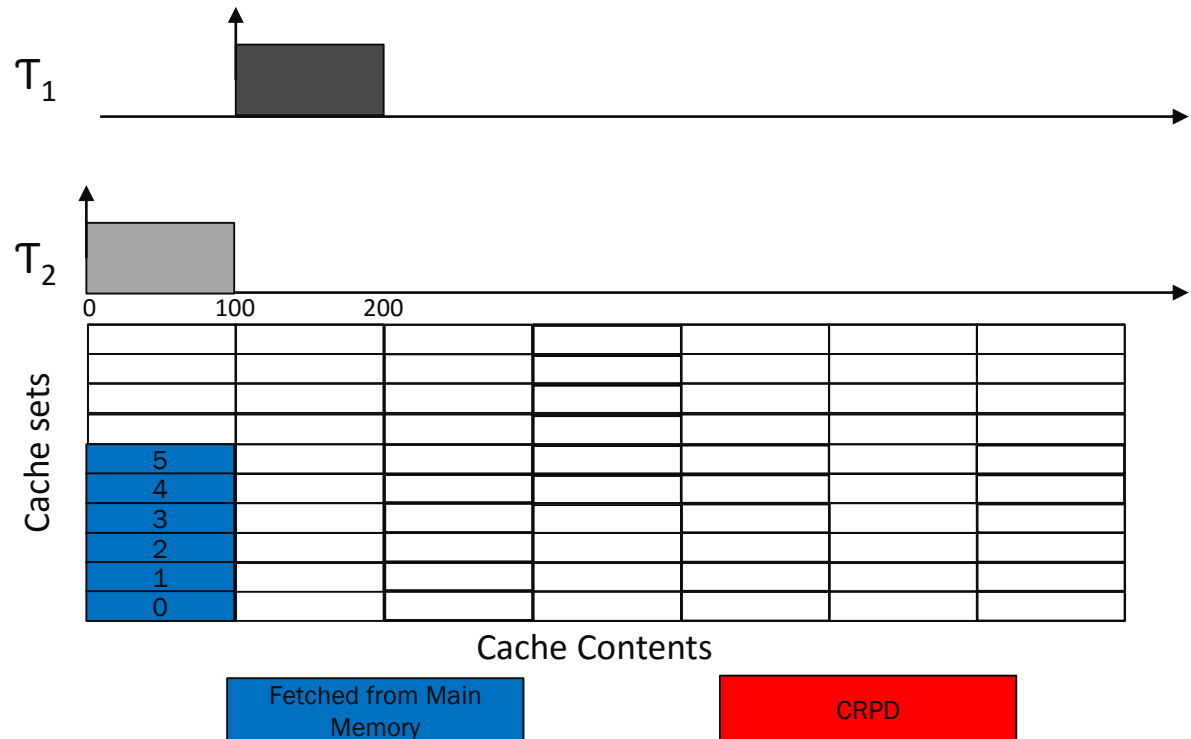
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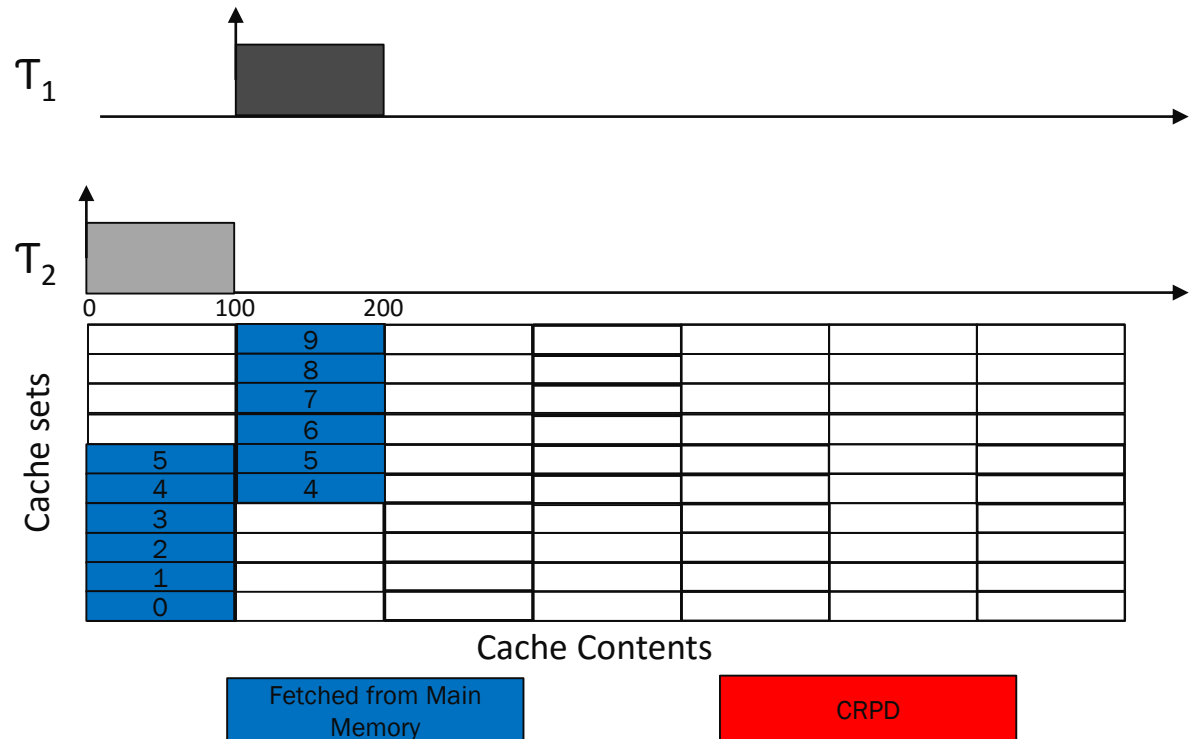
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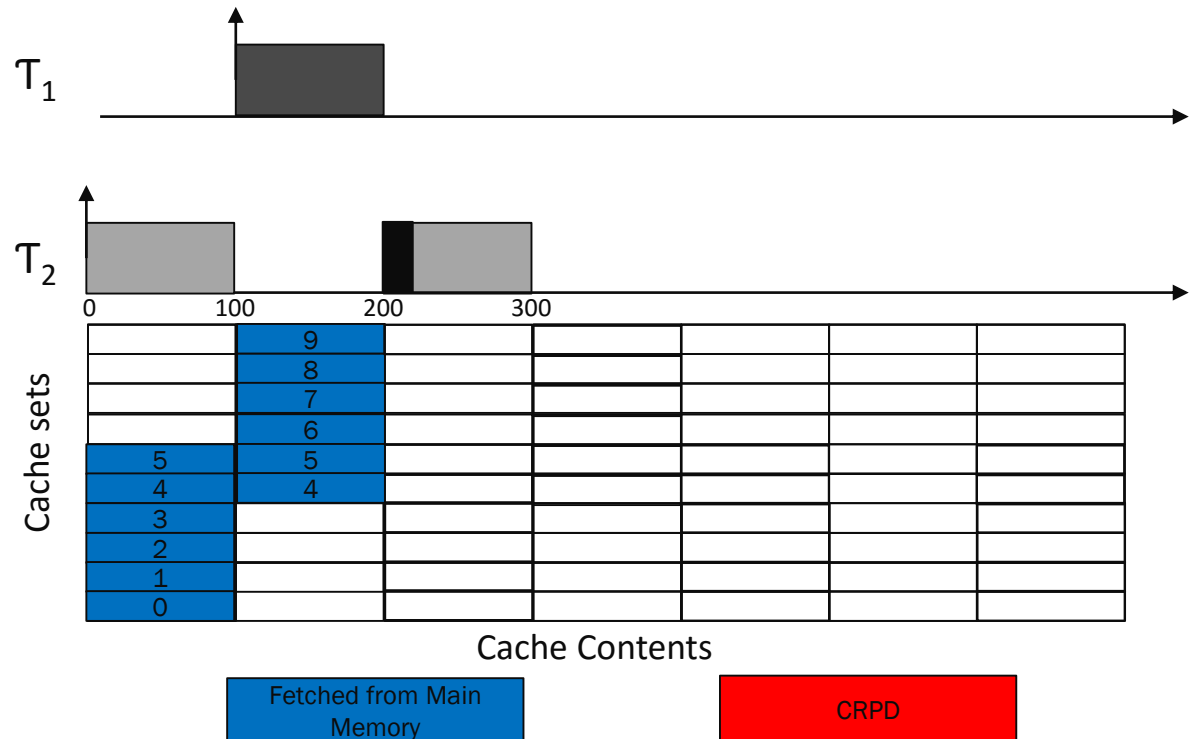


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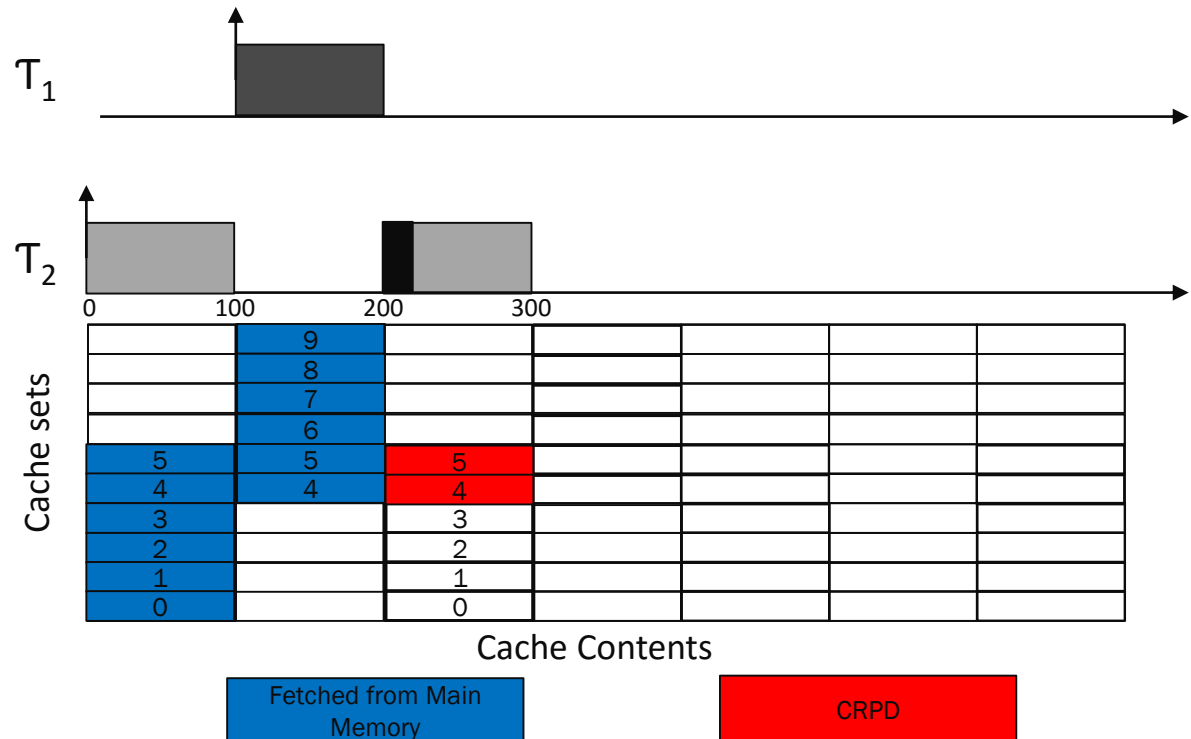


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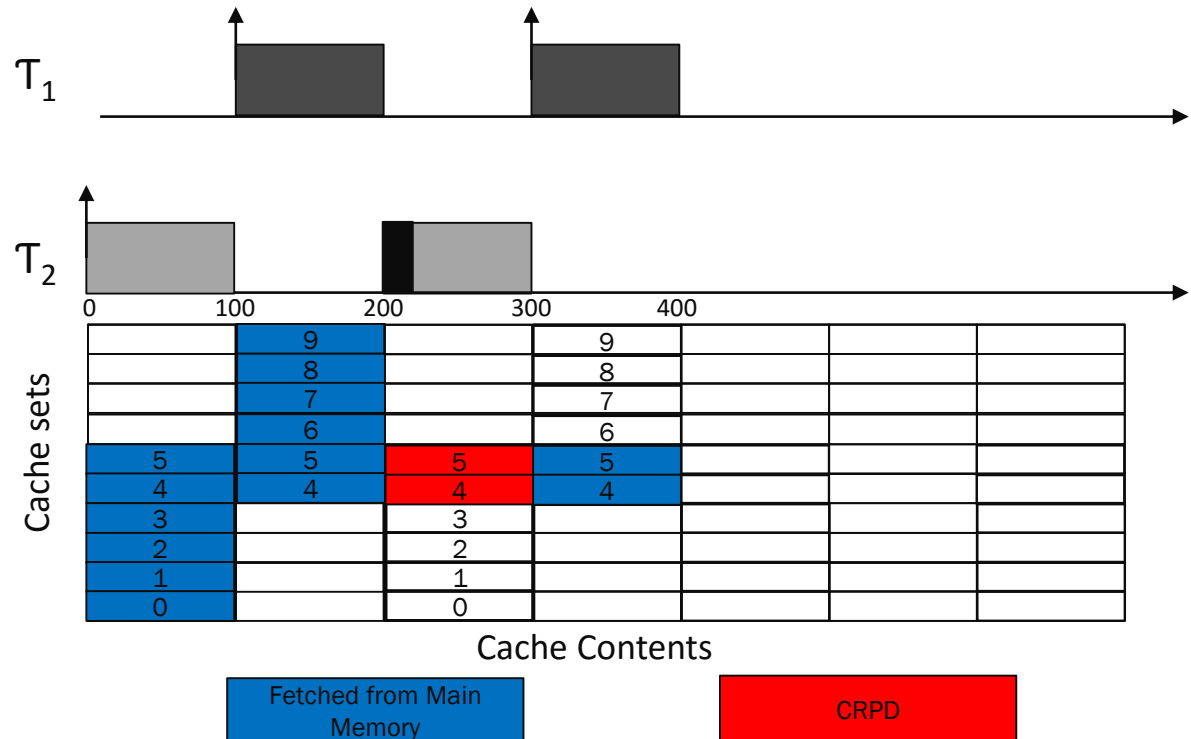


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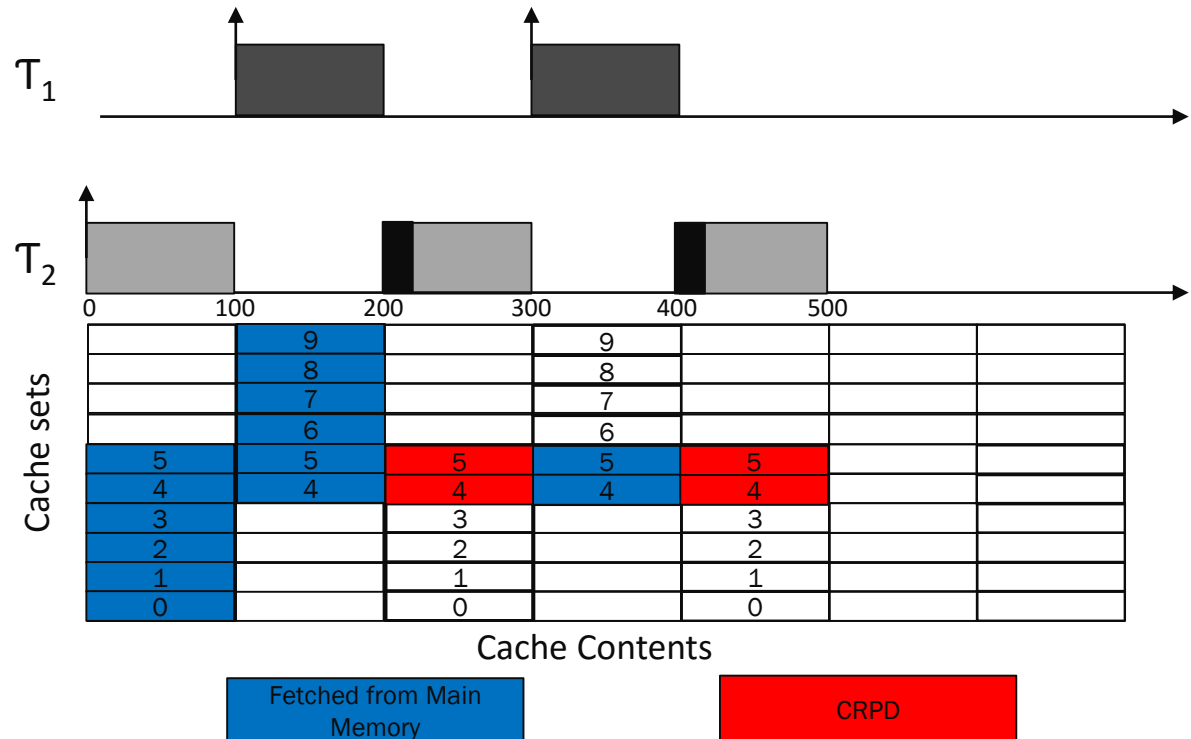


Motivational Example

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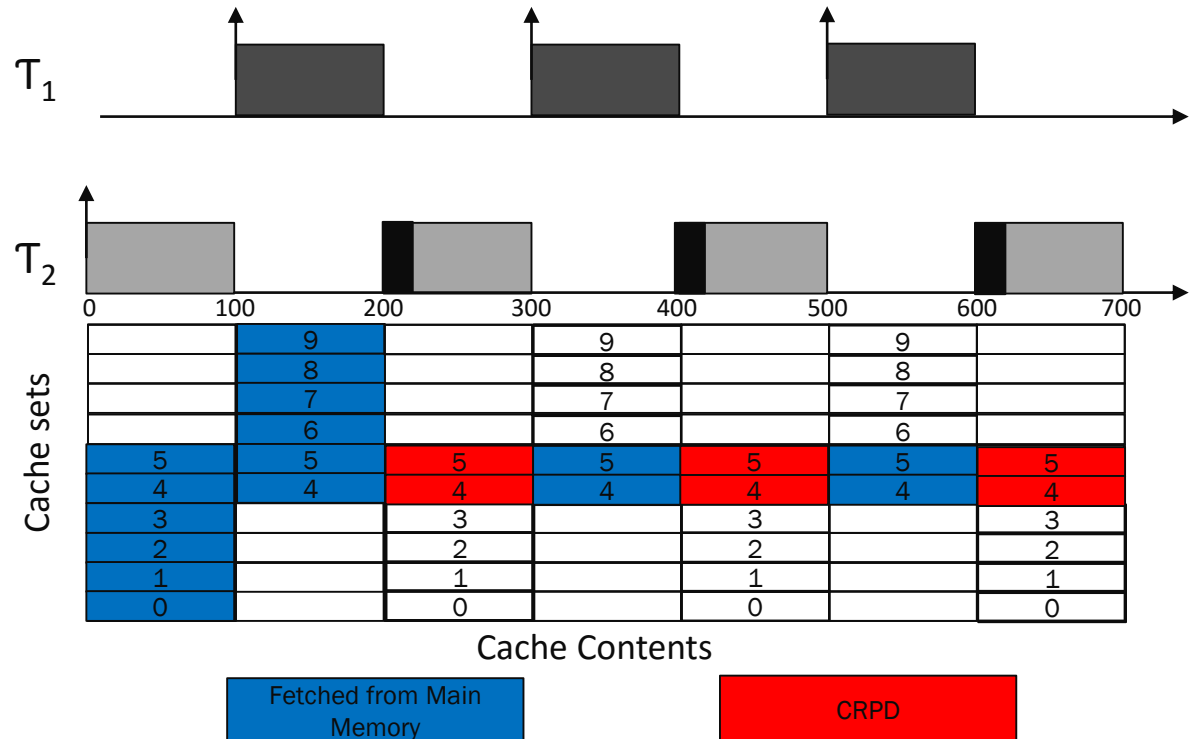
$C_1 = 100$ and $T_1 = 200$

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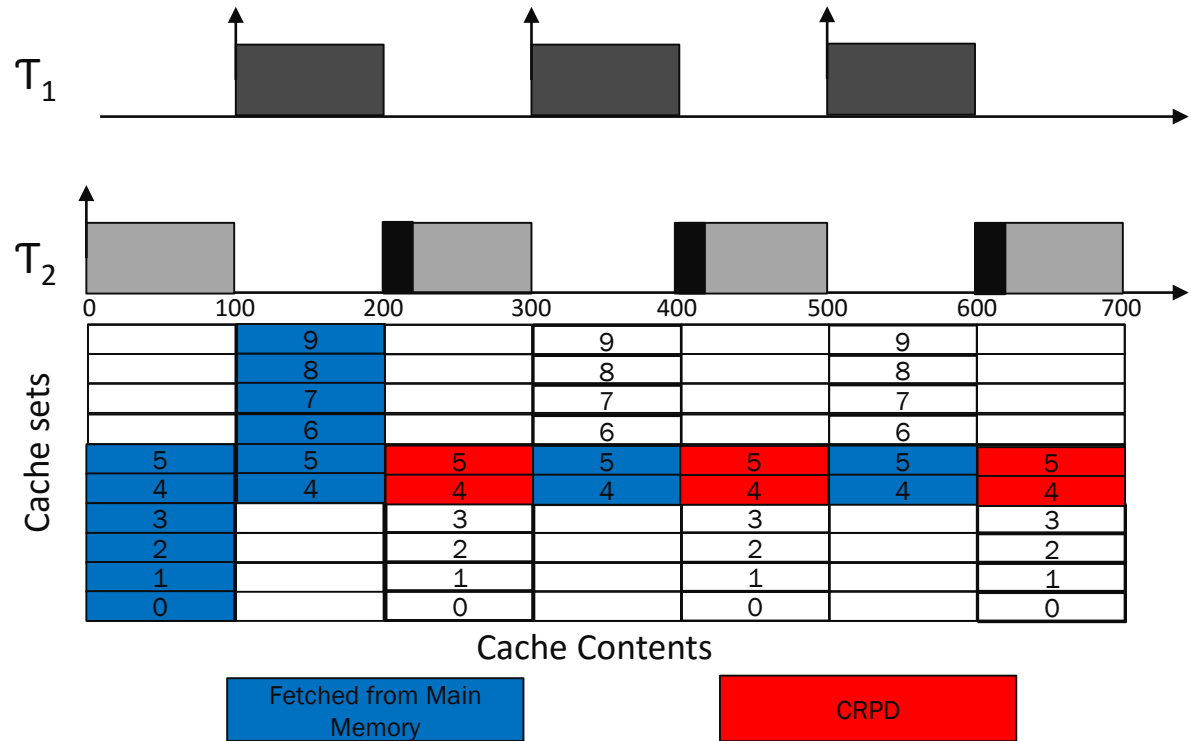
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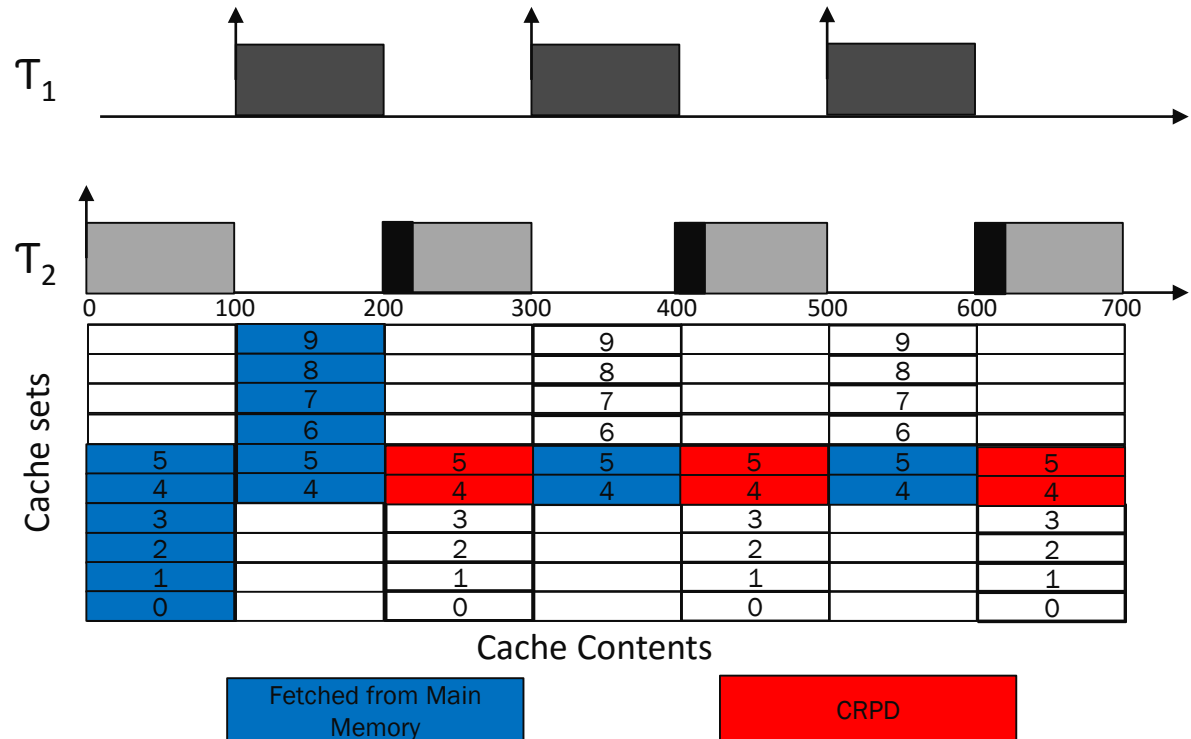
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$$MD(R_2) = MD_2 + 3MD_1 + CRPD$$

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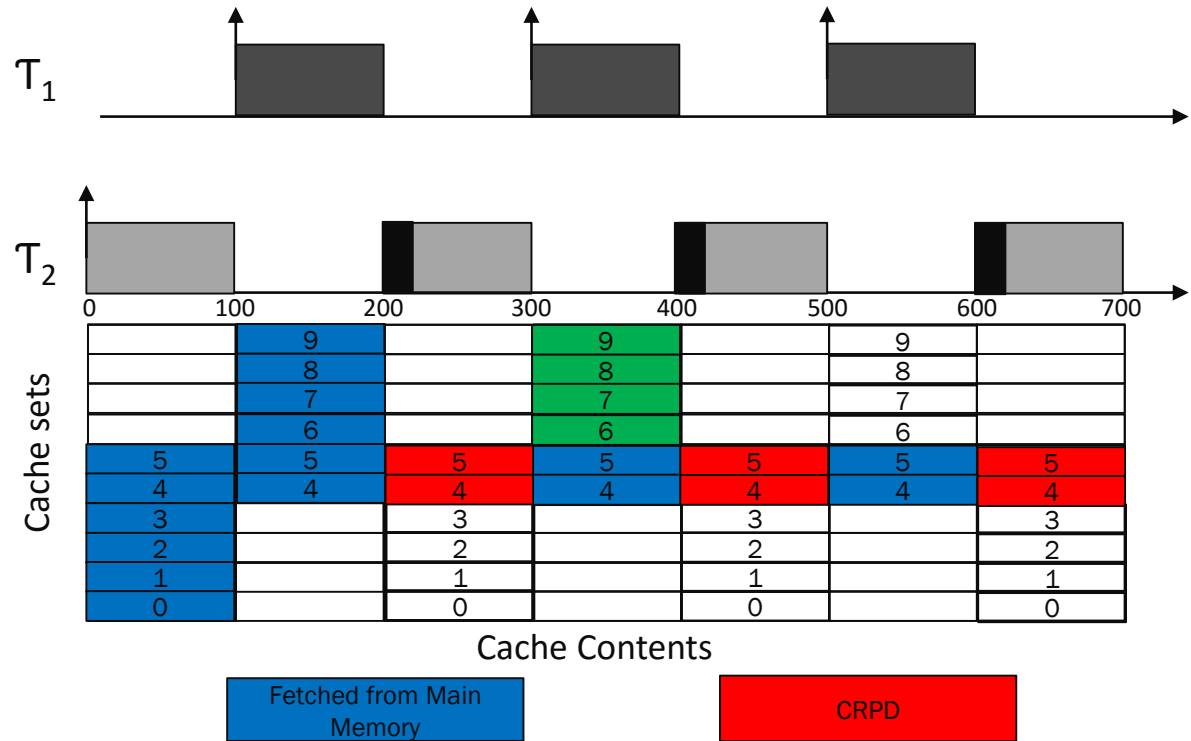


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PESIMISTIC

Motivational Example

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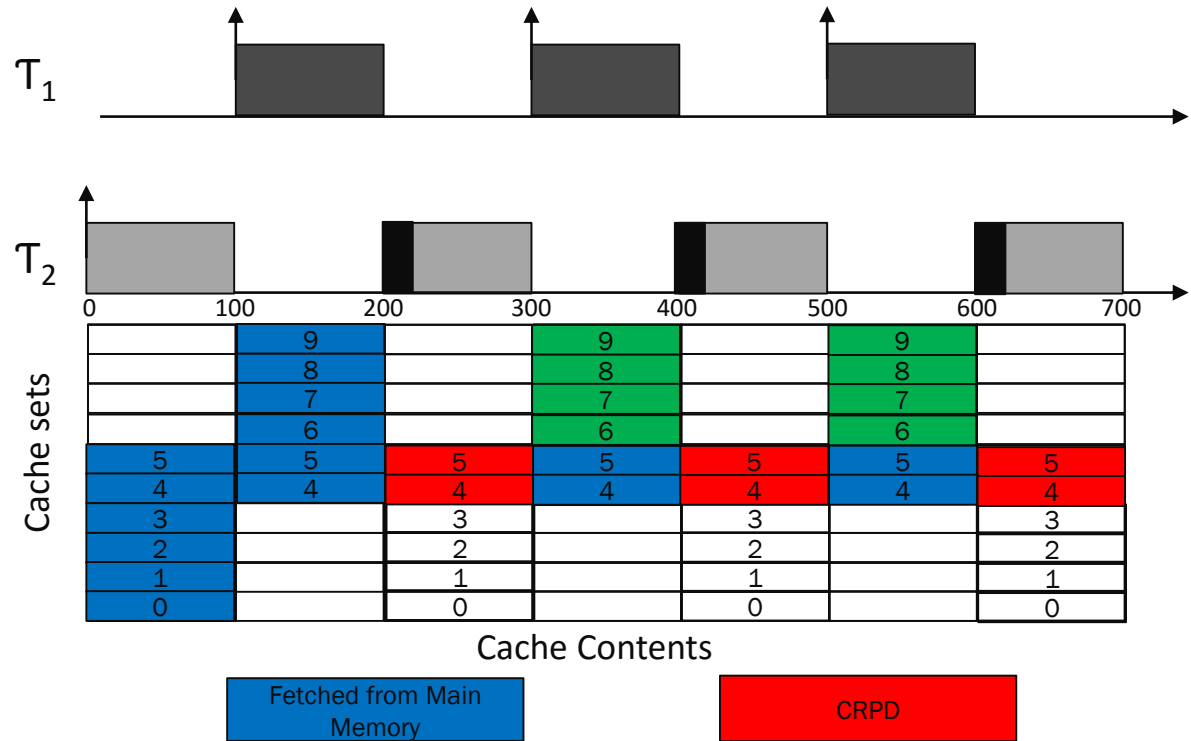


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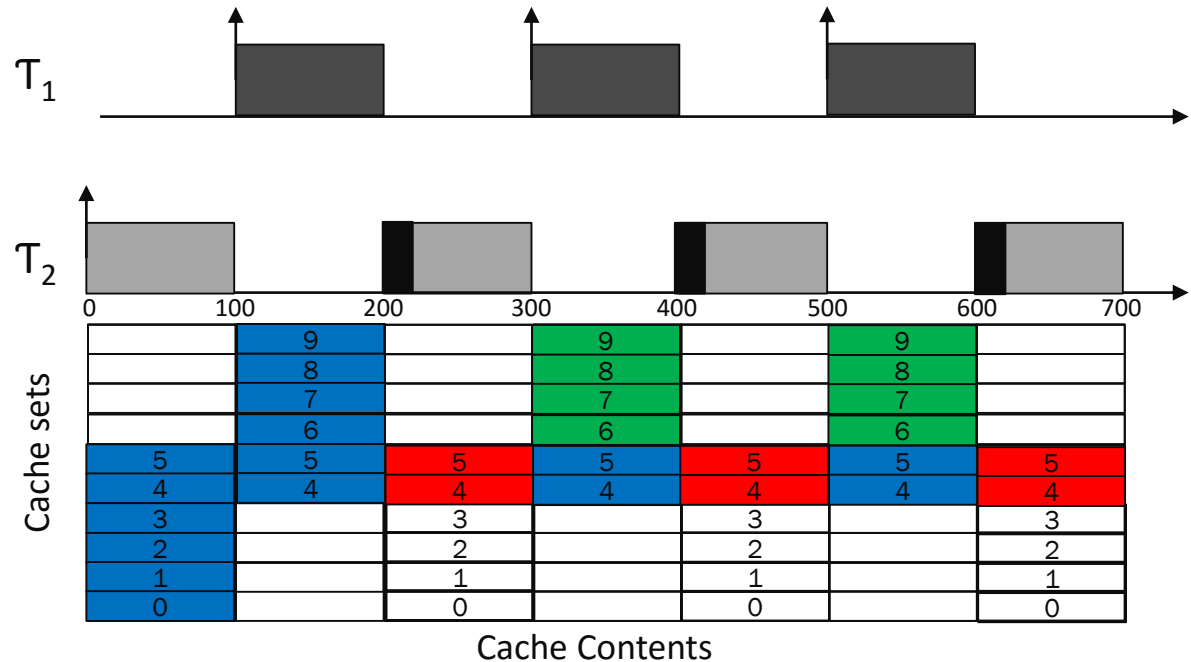


$$MD(R_2) = MD_2 + 3MD_1 + CRPD$$

PESIMC3

Motivational Example

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$$MD(R_2) = MD_2 + 3MD_1 + CRPD$$

PESIMISTIC

$$MD(R_2) = MD_2 + MD_1 + 2(MD_1 - |PCB|) + CRPD$$

Contributions



Contributions

- Improved WCRT analysis for fixed priority preemptive systems

$$R_i(t) = P_i + MD_i + \sum_{\forall j \in hp(i)} P_j + MD_j + \sum_{\forall j \in hp(i)} CRPD_{i,j} \\ + \sum_{\forall j \in hp(i)} \left\lceil \frac{R_i}{T_j} - 1 \right\rceil * (P_j + MD^r_j + CPRO_{j,i})$$

Contributions

- Improved WCRT analysis for fixed priority preemptive systems

$$R_i(t) = P_i + MD_i + \sum_{\forall j \in hp(i)} P_j + MD_j + \sum_{\forall j \in hp(i)} \mathbf{CRPD}_{i,j}$$
$$+ \sum_{\forall j \in hp(i)} \left\lceil \frac{R_i}{T_j} - 1 \right\rceil * (P_j + \underbrace{MD_j^r}_{\text{Considering the effect of PCBs}} + \mathbf{CPRO}_{j,i})$$

Contributions

- Improved WCRT analysis for fixed priority preemptive systems

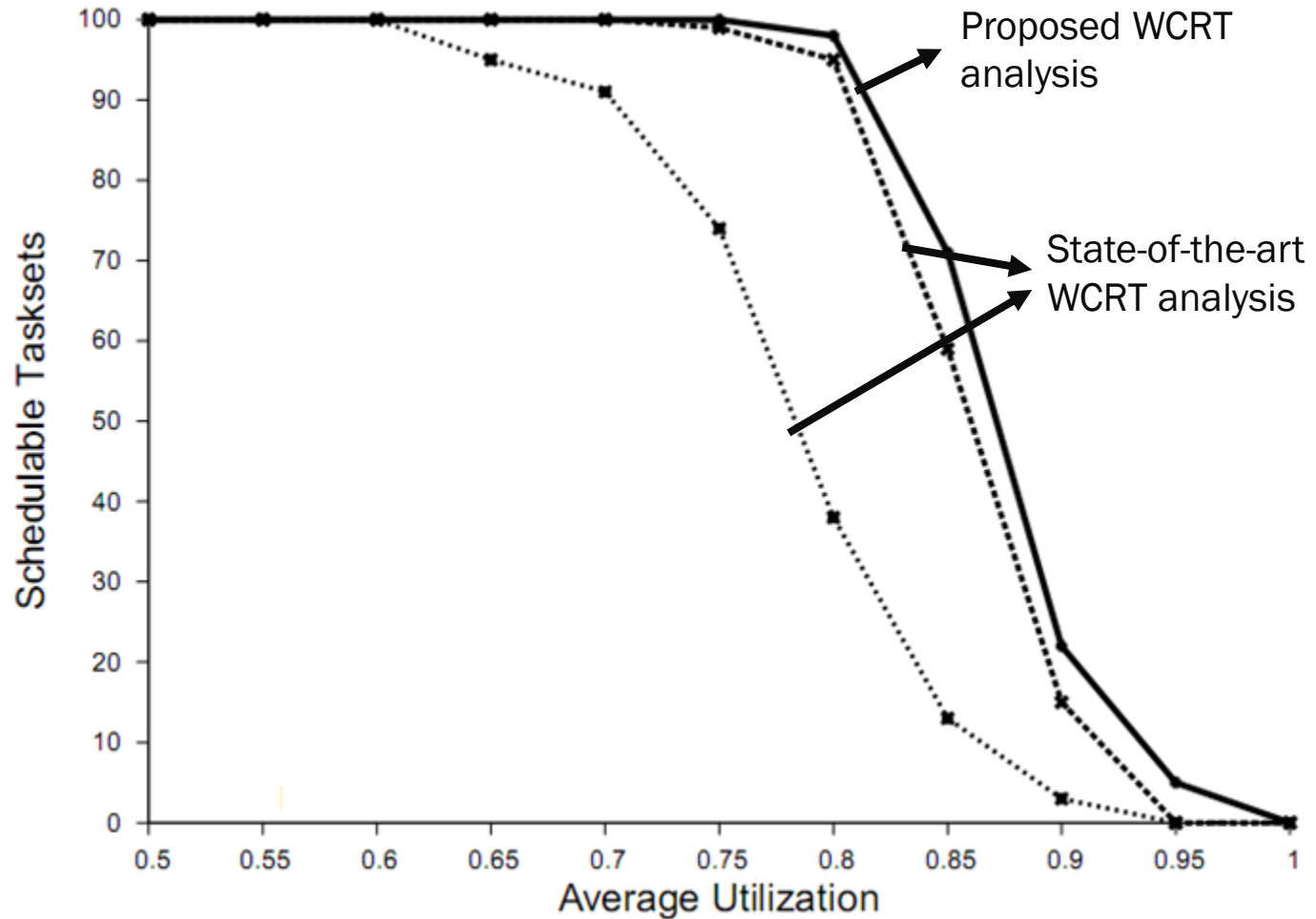
$$\begin{aligned}
 R_i(t) = & P_i + MD_i + \sum_{\forall j \in hp(i)} P_j + MD_j + \sum_{\forall j \in hp(i)} \mathbf{CRPD}_{i,j} \\
 & + \sum_{\forall j \in hp(i)} \left\lceil \frac{R_i}{T_j} - 1 \right\rceil * (P_j + \underbrace{MD_j^r}_{\text{Considering the effect of PCBs}} + \underbrace{CPRD_{j,i}}_{\text{Considering evictions of PCBs}})
 \end{aligned}$$

Contributions

- Improved WCRT analysis for fixed priority preemptive systems

$$\begin{aligned}
 R_i(t) = & P_i + MD_i + \sum_{\forall j \in hp(i)} P_j + MD_j + \sum_{\forall j \in hp(i)} \overbrace{CRPD_{i,j}}^{\text{Considering the effect of CRPD}} \\
 & + \sum_{\forall j \in hp(i)} \left[\frac{R_i}{T_j} - 1 \right] * \left(P_j + \underbrace{MD^r_j}_{\text{Considering the effect of PCBs}} + \overbrace{CPR0_{j,i}}^{\text{Considering evictions of PCBs}} \right)
 \end{aligned}$$

Preliminary Results



Future Work

- Extend the analysis to **set associative** and **data caches**.
- Provide a less pessimistic **multi-set approach** to calculate the impact of PCBs.
- Combine approaches to calculate **both CRPD** and impact of PCBs.
- **Extensive experimental evaluation** using available benchmarks.



Thank You

