Summary

- Response times for FPPS
  - Without jitter
  - With release jitter
  - Completion (or end) jitter
  - Example
- Resource reservation

Response times for FPPS

\[
\begin{align*}
WR_j &= \sup_{\psi_j} R_{j,i} \\
BR_j &= \inf_{\psi_j} R_{j,i} \\
\text{Critical instant: } x &= C_j + \sum \frac{x}{T_j} C_j \\
\text{Optimal instant: } x &= C_j + \sum \left( \frac{x}{T_j} - 1 \right) C_j \\
\text{solved by means of an iterative procedure} \\
\text{smallest positive solution} &\text{ highest lower bound} \\
\text{largest positive solution} &\text{ lowest upper bound} \\
\text{can also be determined by means of a time line}
\end{align*}
\]
Response times with release jitter $AJ$

<table>
<thead>
<tr>
<th>Worst-case response times</th>
<th>Best-case response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>$WR_j = \sup_{q_i,j} R_{q_i,j}$</td>
<td>$BR_j = \inf_{q_i,j} R_{q_i,j}$</td>
</tr>
</tbody>
</table>

Critical instant* \hspace{1cm} Optimal instant*

\[ x = C_j + \left( \sum_{i=1}^{N} \left( \frac{x + AJ_i}{T_i} \right) \right) C_j \]

smallest positive solution \hspace{1cm} highest lower bound

solved by means of an iterative procedure

\[ x = C_j + \sum_{i=1}^{N} \left( \frac{x - AJ_i}{T_i} - 1 \right) C_j \]

largest positive solution \hspace{1cm} lowest upper bound

can also be determined by means of a time line

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Completion (or end) jitter $EJ$

$EJ_j$ of a task $\tau_j$ excluding release jitter:

$EJ_j = \sup_{q_i,j} (R_{q_i,j} - R_{j,k}) \leq WR_j - BR_j$

$EJ_j$ of a task $\tau_j$ including release jitter:

$EJ_j \leq AJ_j + WR_j^* - BR_j^*$

Where the * denotes: including release jitter

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Completion and release jitter

Example:

- Task $\tau_1$
  - $T_1 = 10$
  - $AJ_1 = 20$
  - $WR_1 = 30$
  - $BR_1 = 40$
- Task $\tau_2$
  - $T_2 = 20$
  - $EJ_2 = 50$
Resource Reservation

- **Definition:**
  - Resource reservation is a technique (or mechanism) at the level of an RTOS, providing a virtual platform.

- **Example:** \((T, B), T = 20 \text{ ms}, B = 5 \text{ ms}\).

- **Multiple resources:**
  - (co-) processor(s), memory, bus, network, ...

- **Motivation:**
  - Priorities used to/for:
    - Guarantee deadlines (FPS and DPS);
    - Assign relative importance (FPS only);
    - Co-operation protocols + concurrency control.