MACHINE m3
REFINES m2
SEES c0
VARIABLES

wait
process
clk
t1
t2
qsize
queue
twish
tenter
tleave

INVARIANTS

inv1: $twish \in \mathbb{N}$

inv2: $tenter \in \mathbb{N}$

inv3: $tleave \in \mathbb{N}$

inv4: $0 \leq twish \land twish \leq clk$

inv5: $0 \leq tenter \land tenter \leq clk$

inv6: $0 \leq tleave \land tleave \leq clk$

inv7: $process = \varnothing \land wait \neq \varnothing \land twish \geq tleave \Rightarrow clk - twish \leq ddl4$

inv12: $process = \varnothing \land wait \neq \varnothing \land tleave \geq twish \Rightarrow clk - tleave \leq ddl4$

inv8: $tenter \geq twish \land twish \geq tleave \Rightarrow tenter - twish \leq ddl4$
deadline(leave,wish,d4)

inv9: $tenter \geq tleave \land tleave \geq twish \Rightarrow tenter - tleave \leq ddl4$
deadline(leave,enter,d4)

inv10: $process \neq \varnothing \Rightarrow clk - tenter \leq ddl2$

inv11: $tleave \geq tenter \Rightarrow tleave - tenter \leq ddl2$
deadline(enter,leave,d2)

inv13: $\forall p \cdot (p \in wait \land p \in dom(t1)) \Rightarrow clk - t1(p) \leq (card(PROCESS) - queue^{-1}(p)) * (ddl2 + ddl4) + ddl4$

EVENTS

Initialisation ⟨extended⟩

begin

act1: $wait := \varnothing$
act2: $process := \varnothing$
act3: $clk := 0$
act4: $t1 := \varnothing$
act5: $t2 := \varnothing$
act7: $qsize := 0$
act8: $queue := \varnothing$
act9: $twish := 0$
act10: $tenter := 0$
act11: $tleave := 0$

end

Event wish_empty ⟨ordinary⟩ $\widehat{=}$
extends wish

any

pro

where

grd1: $pro \in PROCESS \setminus wait$
grd2: $pro \in PROCESS \setminus process$
grd3: $wait = \varnothing \land process = \varnothing$

then

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        act1: $wait := wait \cup \{pro\}$
        act2: $t1(pro) := clk$
        act3: $queue(qsize + 1) := pro$
        act4: $qsize := qsize + 1$
        act5: $twish := clk$
    end
Event wish_nonempty ⟨ordinary⟩ $\widehat{=}$
extends wish
    any
        $pro$
    where
        grd1: $pro \in PROCESS \setminus wait$
        grd2: $pro \in PROCESS \setminus process$
        grd3: $wait \neq \varnothing \lor process \neq \varnothing$
    then
        act1: $wait := wait \cup \{pro\}$
        act2: $t1(pro) := clk$
        act3: $queue(qsize + 1) := pro$
        act4: $qsize := qsize + 1$
    end
Event enter ⟨ordinary⟩ $\widehat{=}$
extends enter
    any
        $pro$
    where
        grd1: $pro \in wait$
        grd2: $card(process) = 0$
        grd3: $qsize > 0$
        grd4: $pro = queue(1)$
    then
        act1: $wait := wait \setminus \{pro\}$
        act2: $process := process \cup \{pro\}$
        act3: $t2(pro) := clk$
        act4: $queue :\mid queue' \in 1 \,..\, qsize - 1 \rightarrowtail\mathrel{\mkern-14mu}\twoheadrightarrow wait \setminus \{queue(1)\} \land (\forall i \cdot i \in 1 \,..\, qsize - 1 \Rightarrow queue'(i) =$
            $queue(i + 1))$
        act5: $qsize := qsize - 1$
        act6: $tenter := clk$
    end
Event leave ⟨ordinary⟩ $\widehat{=}$
extends leave
    any
        $pro$
    where
        grd1: $pro \in process$
        grd2: $queue \neq \varnothing$
    then
        act1: $process := process \setminus \{pro\}$
        act3: $tleave := clk$
    end
Event leave_idle ⟨ordinary⟩ $\widehat{=}$
extends leave
    any
        $pro$
    where
        grd1: $pro \in process$
        grd2: $queue = \varnothing$
    then
        act1: $process := process \setminus \{pro\}$
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            act2: $tleave := clk$
      end
Event tick ⟨ordinary⟩ $\widehat{=}$
refines tick
      when
            grd2:   $process = \varnothing \land wait \neq \varnothing \land twish \geq tleave \Rightarrow clk + 1 - twish \leq ddl4$
            grd3:   $process = \varnothing \land wait \neq \varnothing \land tleave \geq twish \Rightarrow clk + 1 - tleave \leq ddl4$
            grd4:   $process \neq \varnothing \Rightarrow clk + 1 - tenter \leq ddl2$
      then
            act1: $clk := clk + 1$
      end
END
```