MACHINE M_PartProc_Manage
REFINES M_PartProc_With_Events
SEES C_Part_Proc_Manage
VARIABLES

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currentpriority_of_process
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location_of_service2
setnorm_wait_procs
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start_aperiod_innormal_proc
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delay_start_ainstart_proc
delay_start_ainnormal_proc

delay_start_ainnormal_delaytime

delay_start_instart_proc

delay_start_innormal_proc

delay_start_innormal_delaytime

req_busy_resource_proc

resource_become_avail_proc

finished_core2

resource_become_avail2

time_wait_proc

period_wait_proc

INVARIANTS

inv_proc_wait_type: $\mathit{process\_wait\_type} \in \mathit{processes} ⇸ \mathit{PROCESS\_WAIT\_TYPES}$

inv_proc_wait_type2: $\forall p\cdot(p \in \mathit{processes} \land p \in \mathit{dom}(\mathit{process\_state}) \land (\mathit{process\_state}(p) = \mathit{PS\_Waiting} \lor \mathit{process\_state}(p) = \mathit{PS\_WaitandSuspend}) \Rightarrow p \in \mathit{dom}(\mathit{process\_wait\_type}))$

inv_locklevel_of_part: $\mathit{locklevel\_of\_partition} \in \mathit{PARTITIONS} ⇸ \mathbb{N}$

inv_startcond_of_part: $\mathit{startcondition\_of\_partition} \in \mathit{PARTITIONS} ⇸ \mathit{PARTITION\_STARTCONDITIONS}$

inv_start_imply_locklevel: $\forall p\cdot(p \in \mathit{PARTITIONS} \cap \mathit{dom}(\mathit{locklevel\_of\_partition}) \land (\mathit{partition\_mode}(p) = \mathit{PM\_COLD\_START} \lor \mathit{partition\_mode}(p) = \mathit{PM\_WARM\_START}) \Rightarrow \mathit{locklevel\_of\_partition}(p) > 0)$

inv_locklevel0_imply_normal: $\forall p\cdot(p \in \mathit{PARTITIONS} \land p \in \mathit{dom}(\mathit{locklevel\_of\_partition}) \land \mathit{locklevel\_of\_partition}(p) = 0 \Rightarrow \mathit{partition\_mode}(p) = \mathit{PM\_NORMAL})$

inv_basepriority_of_proc: $\mathit{basepriority\_of\_process} \in \mathit{processes} ⇸ \mathit{MIN\_PRIORITY}\,..\,\mathit{MAX\_PRIORITY}$

inv_currentpriority_of_proc: $\mathit{currentpriority\_of\_process} \in \mathit{processes} ⇸ \mathit{MIN\_PRIORITY}\,..\,\mathit{MAX\_PRIORITY}$

inv_retainedpriority_of_proc: $\mathit{retainedpriority\_of\_process} \in \mathit{processes} ⇸ \mathit{MIN\_PRIORITY}\,..\,\mathit{MAX\_PRIORITY}$

inv_period_of_proc: $\mathit{period\_of\_process} \in \mathit{processes} ⇸ \mathbb{N}$

inv_timecapacity_of_proc: $\mathit{timecapacity\_of\_process} \in \mathit{processes} ⇸ \mathbb{N}$

inv_deadline_of_proc: $\mathit{deadline\_of\_process} \in \mathit{processes} ⇸ \mathit{DEADLINE\_TYPE}$

inv_deadlinetime_of_proc: $\mathit{deadlinetime\_of\_process} \in \mathit{processes} ⇸ \mathbb{N}$

inv_releasepoint_of_process: $\mathit{releasepoint\_of\_process} \in \mathit{processes} ⇸ \mathbb{N}$

inv_releasepoint_of_process2:
$\forall pt, p\cdot(pt \in \mathit{PARTITIONS} \land p \in \mathit{processes} \land p \in \mathit{dom}(\mathit{processes\_of\_partition}) \land p \in \mathit{dom}(\mathit{period\_of\_process}) \land p \in \mathit{dom}(\mathit{process\_state}) \land p \in \mathit{dom}(\mathit{periodtype\_of\_process}) \land \mathit{partition\_mode}(pt) = \mathit{PM\_NORMAL} \land \mathit{processes\_of\_partition}(p) = pt \land \mathit{periodtype\_of\_process}(p) = \mathit{PERIOD\_PROC} \land (\mathit{process\_state}(p) = \mathit{PS\_Running} \lor \mathit{process\_state}(p) = \mathit{PS\_Waiting} \lor \mathit{process\_state}(p) = \mathit{PS\_Ready}) \Rightarrow p \in \mathit{dom}(\mathit{releasepoint\_of\_process}))$

inv_delaytime_of_proc: $\mathit{delaytime\_of\_process} \in \mathit{processes} ⇸ \mathbb{N}$

inv_delaytime_of_proc2: $\forall p\cdot(p \in \mathit{processes} \land p \in \mathit{dom}(\mathit{process\_state}) \land p \in \mathit{dom}(\mathit{process\_wait\_type}) \land (\mathit{process\_state}(p) = \mathit{PS\_Waiting} \lor \mathit{process\_state}(p) = \mathit{PS\_WaitandSuspend}) \land \mathit{process\_wait\_type}(p) = \mathit{PROC\_WAIT\_DELAY} \Rightarrow p \in \mathit{dom}(\mathit{delaytime\_of\_process}))$

inv_periodtype1: $\forall p\cdot(p \in \mathit{processes} \land p \in \mathit{dom}(\mathit{period\_of\_process}) \land p \in \mathit{dom}(\mathit{periodtype\_of\_process}) \Rightarrow (\mathit{periodtype\_of\_process}(p) = \mathit{APERIOD\_PROC} \Leftrightarrow \mathit{period\_of\_process}(p) = \mathit{INFINITE\_TIME\_VALUE}))$

inv_periodtype2: $\forall p\cdot(p \in \mathit{processes} \land p \in \mathit{dom}(\mathit{period\_of\_process}) \land p \in \mathit{dom}(\mathit{periodtype\_of\_process}) \Rightarrow (\mathit{periodtype\_of\_process}(p) = \mathit{PERIOD\_PROC} \Leftrightarrow \mathit{period\_of\_process}(p) > 0))$

inv_current_part: $\mathit{current\_partition} \in \mathit{PARTITIONS}$

inv_current_partition_flag: $\mathit{current\_partition\_flag} \in \mathit{PARTITIONS} ⇸ \mathit{BOOL}$

inv_current_procs_flag: $\mathit{current\_processes\_flag} \in \mathit{CORES} \to \mathit{BOOL}$

inv_cur_procs: $\forall \mathit{core}\cdot(\mathit{core} \in \mathit{CORES} \land \mathit{current\_processes\_flag}(\mathit{core}) = \mathit{TRUE} \Rightarrow \mathit{current\_processes} \in \mathit{CORES} ⇸ \mathit{processes})$

inv_current_procs_flag_imply_current_procs: $\forall \mathit{core}\cdot(\mathit{core} \in \mathit{current\_processes\_flag}^{-1}[\{\mathit{TRUE}\}] \Rightarrow \mathit{core} \in \mathit{dom}(\mathit{current\_processes}))$

inv_curprocimplycurpart: $\forall core\cdot(core \in dom(current\_processes)\land core \in dom(current\_processes\_flag)\land$
$current\_partition \in dom(current\_partition\_flag)\land current\_processes\_flag(core) = TRUE\Rightarrow current\_partition\_flag(cu$
$TRUE)$

invcurrent_part: $(current\_partition \in dom(current\_partition\_flag)\land current\_partition\_flag(current\_partition) =$
$TRUE \Rightarrow partition\_mode(current\_partition) \neq PM\_IDLE)$

inv_finished_core2: $finished\_core2 \in CORES \rightarrow BOOL$

inv_clock_tick: $clock\_tick \in \mathbb{N}$

inv_need_reschedule: $need\_reschedule \in BOOL$

inv_need_procresch: $need\_procresch \in CORES \nrightarrow BOOL$

inv_preempter_of_part: $preempter\_of\_partition \in PARTITIONS \rightarrowtail\!\!\!\!\!\!\!\!\nrightarrow processes$

inv_preempter_of_part2: $\forall part\cdot(part \in PARTITIONS \land part \in dom(preempter\_of\_partition) \land$
$preempter\_of\_partition(part) \in dom(processes\_of\_partition)\Rightarrow processes\_of\_partition(preempter\_of\_partition(part))$
$part)$

inv_locklevel_imply_preempter: $\forall part\cdot(part \in PARTITIONS\land part \in dom(locklevel\_of\_partition)\land$
$partition\_mode(part) = PM\_NORMAL\land locklevel\_of\_partition(part) > 0\Rightarrow part \in dom(preempter\_of\_partition))$

inv_locklevel_imply_preempter2: $\forall part\cdot(part \in PARTITIONS\land part \in dom(locklevel\_of\_partition)\land$
$part \in dom(preempter\_of\_partition)\land partition\_mode(part) = PM\_NORMAL\Rightarrow locklevel\_of\_partition(part) >$
$0)$

inv_preemption_lock_mutex: $preemption\_lock\_mutex \in processes \nrightarrow BOOL$
only one owns the TRUE??????

inv_preemption_lock_mutex_nomore_one_true: $\forall p1, p2\cdot(p1 \in processes\land p2 \in processes\land p1 \in dom(preemption\_lock\_mute$
$p2 \in dom(preemption\_lock\_mutex)\land preemption\_lock\_mutex(p1) = TRUE\land preemption\_lock\_mutex(p2) =$
$TRUE \Rightarrow p1 = p2)$

inv_timeout_trig_type: $timeout\_trigger \in processes \nrightarrow (PROCESS\_STATES \times \mathbb{N}_1)$

inv_timeout_trig_state: $\forall proc\cdot(proc \in dom(timeout\_trigger)\land proc \in dom(process\_state)\Rightarrow(process\_state(proc) =$
$PS\_Waiting \lor process\_state(proc) = PS\_Suspend \lor process\_state(proc) = PS\_WaitandSuspend))$

inv_errhandler_part: $errorhandler\_of\_partition \in PARTITIONS \rightarrowtail\!\!\!\!\!\!\!\!\nrightarrow processes$
maybe modify?????

inv_errhandler_inpartition: $\forall part, p\cdot(p \in dom(processes\_of\_partition)\land part \mapsto p \in errorhandler\_of\_partition\Rightarrow$
$processes\_of\_partition(p) = part)$

inv_process_call_errorhandler: $process\_call\_errorhandler \in processes \rightarrowtail\!\!\!\!\!\!\!\!\nrightarrow processes$

inv_errhandlerandcaller_insamepart: $\forall p1, p2\cdot(p1 \in dom(processes\_of\_partition)\land p2 \in dom(processes\_of\_partition)\land$
$p1 \mapsto p2 \in process\_call\_errorhandler \Rightarrow processes\_of\_partition(p1) = processes\_of\_partition(p2))$

inv_errhandler_isnot_caller: $\forall p1, p2\cdot(p1 \mapsto p2 \in process\_call\_errorhandler \Rightarrow p1 \neq p2)$

inv_location_of_service2: $location\_of\_service2 \in CORES \nrightarrow (Services \times Location)$

inv_gluing_set_normal_loc_i:
$\forall core\cdot(core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_i \Rightarrow$
$core \in dom(location\_of\_service) \land location\_of\_service(core) = Set\_Normal \mapsto loc\_i)$

inv_gluing_set_normal_loc_1:
$\forall core\cdot(core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_1 \Rightarrow$
$core \in dom(location\_of\_service) \land location\_of\_service(core) = Set\_Normal \mapsto loc\_1)$

inv_gluing_set_normal_loc_2:
$\forall core\cdot(core \in dom(location\_of\_service2) \land (location\_of\_service2(core) = Set\_Normal \mapsto loc\_2$
$\lor location\_of\_service2(core) = Set\_Normal \mapsto loc\_3 \lor location\_of\_service2(core) = Set\_Normal \mapsto$
$loc\_4 \lor location\_of\_service2(core) = Set\_Normal \mapsto loc\_5) \Rightarrow$
$core \in dom(location\_of\_service) \land location\_of\_service(core) = Set\_Normal \mapsto loc\_2)$

inv_gluing_set_normal_loc_r:
$\forall core\cdot(core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_r \Rightarrow$
$core \in dom(location\_of\_service) \land location\_of\_service(core) = Set\_Normal \mapsto loc\_r)$

inv_set_normal_and_finished_core:
$\forall core\cdot(core \in dom(location\_of\_service2) \land (location\_of\_service2(core) = Set\_Normal \mapsto loc\_i \lor$
$location\_of\_service2(core) = Set\_Normal \mapsto loc\_1 \lor location\_of\_service2(core) = Set\_Normal \mapsto$
loc_2
$\lor location\_of\_service2(core) = Set\_Normal \mapsto loc\_3 \lor location\_of\_service2(core) = Set\_Normal \mapsto$
$loc\_4 \lor location\_of\_service2(core) = Set\_Normal \mapsto loc\_5)$
$\Rightarrow finished\_core(core) = FALSE)$

inv_set_priority_and_finished_core:
$\forall core\cdot(core \in dom(location\_of\_service2) \land (location\_of\_service2(core) = Set\_Priority \mapsto loc\_i \lor location\_of\_service2(core) = Set\_Priority \mapsto loc\_1 \lor location\_of\_service2(core) = Set\_Priority \mapsto loc\_2)$
$\Rightarrow finished\_core2(core) = FALSE)$

inv_setnorm_wait_procs: $setnorm\_wait\_procs \in CORES ⇸ \mathbb{P}\,(processes)$

inv_setnormal_suspend_procs: $setnorm\_susp\_procs \in CORES ⇸ \mathbb{P}\,(processes)$

inv_set_priority_parm: $set\_priority\_parm \in CORES ⇸ MIN\_PRIORITY \mathrel{..} MAX\_PRIORITY$

inv_suspend_self_param: $suspend\_self\_timeout \in CORES ⇸ \mathbb{Z}$

inv_suspend_self_waitproc: $suspend\_self\_waitproc \in CORES ⇸ processes$

inv_resume_proc: $resume\_proc \in CORES ⇸ processes$

inv_stop_self_procparam: $stop\_self\_proc \in CORES ⇸ processes$

inv_stop_proc_param: $stop\_proc \in CORES ⇸ processes$

inv_start_aperiod_proc: $start\_aperiod\_proc \in CORES ⇸ processes$

inv_start_aperiod_innormal: $start\_aperiod\_innormal\_proc \in CORES ⇸ processes$

inv_Start_period_instart_proc: $start\_period\_instart\_proc \in CORES ⇸ processes$

inv_start_period_innormal_proc: $start\_period\_innormal\_proc \in CORES ⇸ processes$

inv_delay_start_ainstart_proc: $delay\_start\_ainstart\_proc \in CORES ⇸ processes$

inv_delay_start_ainnormal_proc: $delay\_start\_ainnormal\_proc \in CORES ⇸ processes$

inv_delay_start_ainnormal_delaytime: $delay\_start\_ainnormal\_delaytime \in CORES ⇸ \mathbb{N}$

inv_delay_start_instart_proc: $delay\_start\_instart\_proc \in CORES ⇸ processes$

inv_delay_start_innormal_proc: $delay\_start\_innormal\_proc \in CORES ⇸ processes$

inv_delay_start_innormal_delaytime: $delay\_start\_innormal\_delaytime \in CORES ⇸ \mathbb{N}$

inv_req_busy_resource_proc: $req\_busy\_resource\_proc \in CORES ⇸ processes$

inv_resource_become_avail_proc: $resource\_become\_avail\_proc \in CORES ⇸ processes$

inv_resource_become_avail2: $resource\_become\_avail2 \in CORES ⇸ \mathbb{P}\,(processes)$

inv_time_wait_proc: $time\_wait\_proc \in CORES ⇸ processes$

inv_period_wait_proc: $period\_wait\_proc \in CORES ⇸ processes$

inv_curCoreofProcinCores: $\forall proc, core\cdot current\_processes(core) = proc \Rightarrow processes\_of\_cores(proc) = core \land core \in Cores\_of\_Partition(processes\_of\_partition(proc))$

EVENTS

Initialisation ⟨extended⟩

begin

act001: $partition\_mode := PARTITIONS \times \{PM\_COLD\_START\}$
act101: $processes := \varnothing$
act102: $processes\_of\_partition := \varnothing$
act103: $process\_state := \varnothing$
act104: $processes\_of\_cores := \varnothing$
act105: $finished\_core := CORES \times \{TRUE\}$
act106: $location\_of\_service := \varnothing$
act201: $periodtype\_of\_process := \varnothing$
act301: $process\_wait\_type := \varnothing$
act302: $locklevel\_of\_partition := PARTITIONS \times \{1\}$
act303: $startcondition\_of\_partition := \varnothing$
act304: $basepriority\_of\_process := \varnothing$
act305: $currentpriority\_of\_process := \varnothing$
act306: $retainedpriority\_of\_process := \varnothing$
act307: $period\_of\_process := \varnothing$
act308: $timecapacity\_of\_process := \varnothing$
act309: $deadline\_of\_process := \varnothing$
act310: $deadlinetime\_of\_process := \varnothing$
act311: $releasepoint\_of\_process := \varnothing$
act312: $delaytime\_of\_process := \varnothing$
act313: $current\_partition :\in PARTITIONS$
act314: $current\_partition\_flag := PARTITIONS \times \{FALSE\}$

act315: $current\_processes := CORES \times \varnothing$

act316: $current\_processes\_flag := CORES \times \{FALSE\}$

act317: $clock\_tick := 1$

act318: $need\_reschedule := FALSE$

act319: $need\_procresch := CORES \times \{FALSE\}$

act320: $preempter\_of\_partition := \varnothing$

act321: $preemption\_lock\_mutex := \varnothing$

act322: $timeout\_trigger := \varnothing$

act323: $errorhandler\_of\_partition := \varnothing$

act324: $process\_call\_errorhandler := \varnothing$

act325: $location\_of\_service2 := \varnothing$

act326: $setnorm\_wait\_procs := \varnothing$

act327: $setnorm\_susp\_procs := \varnothing$

act328: $set\_priority\_parm := \varnothing$

act329: $suspend\_self\_timeout := \varnothing$

act330: $suspend\_self\_waitproc := \varnothing$

act331: $resume\_proc := \varnothing$

act332: $stop\_self\_proc := \varnothing$

act333: $stop\_proc := \varnothing$

act334: $start\_aperiod\_proc := \varnothing$

act335: $start\_aperiod\_innormal\_proc := \varnothing$

act336: $start\_period\_instart\_proc := \varnothing$

act337: $start\_period\_innormal\_proc := \varnothing$

act338: $delay\_start\_ainstart\_proc := \varnothing$

act339: $delay\_start\_ainnormal\_proc := \varnothing$

act340: $delay\_start\_ainnormal\_delaytime := \varnothing$

act341: $delay\_start\_instart\_proc := \varnothing$

act342: $delay\_start\_innormal\_proc := \varnothing$

act343: $delay\_start\_innormal\_delaytime := \varnothing$

act344: $req\_busy\_resource\_proc := \varnothing$

act345: $resource\_become\_avail\_proc := \varnothing$

act346: $finished\_core2 := CORES \times \{TRUE\}$

act347: $resource\_become\_avail2 := \varnothing$

act348: $time\_wait\_proc := \varnothing$

act349: $period\_wait\_proc := \varnothing$

end

Event ticktock ⟨ordinary⟩ $\widehat{=}$

begin

act001: $clock\_tick := clock\_tick + 1$

act002: $need\_reschedule := TRUE$

end

Event partition_schedule ⟨ordinary⟩ $\widehat{=}$

extends partition_schedule

any

part

where

grd001: $part \in PARTITIONS$

grd002: $partition\_mode(part) = PM\_NORMAL \lor partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd101: $need\_reschedule = TRUE$

grd102: $\exists offset, dur \cdot part\_sched\_list(partition2num(part)) = (offset \mapsto dur) \land clock\_tickmodmajorFrame \geq offset \land clock\_tickmodmajorFrame < offset + dur$

then

act101: $need\_reschedule := FALSE$

act102: $current\_partition := part$

act103: $need\_procresch := need\_procresch \mathbin{<\!\!+} (Cores\_of\_Partition(part) \times \{TRUE\})$

end

Event process_schedule ⟨ordinary⟩ $\widehat{=}$

extends process_schedule

any

part
proc
core
errproc

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(process\_state) \cap dom(processes\_of\_cores) \cap dom(processes\_of\_partition)$

grd003: $core \in CORES$
grd004: $processes\_of\_partition(proc) = part$
grd005: $core \in Cores\_of\_Partition(part)$
grd006: $processes\_of\_cores(proc) = core$
grd007: $partition\_mode(part) = PM\_NORMAL$
grd008: $process\_state(proc) = PS\_Ready \lor process\_state(proc) = PS\_Running$
grd208: $errproc \in processes$
grd210: $part \in dom(errorhandler\_of\_partition)$
grd209: $errorhandler\_of\_partition(part) = errproc$
grd212: $core \in ran(processes\_of\_cores)$
grd213: $core \in dom(need\_procresch)$
grd206: $proc \in dom(currentpriority\_of\_process)$
grd207: $part \in dom(locklevel\_of\_partition)$
grd211: $proc \in ran(errorhandler\_of\_partition)$
grd201: $need\_procresch(core) = TRUE$
grd202: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$
grd203: $(current\_partition \notin dom(errorhandler\_of\_partition) \lor process\_state(errproc) = PS\_Dormant) \land locklevel\_of\_partition(current\_partition) = 0$
grd204: $\forall p \cdot (p \in processes\_of\_partition^{-1}[\{part\}] \land p \in dom(currentpriority\_of\_process) \Rightarrow currentpriority\_of\_process(p) \leq currentpriority\_of\_process(proc))$

then

act201: $process\_state := (process\_state \mathbin{<\!\!+} \{current\_processes(core) \mapsto PS\_Ready\}) \mathbin{<\!\!+} \{proc \mapsto PS\_Running\}$
act202: $current\_processes(core) := proc$
act203: $current\_processes\_flag(core) := TRUE$
act204: $need\_reschedule := FALSE$
act205: $need\_procresch(core) := FALSE$

end

Event get_partition_status ⟨ordinary⟩ $\widehat{=}$

any

part
core

where

grd001: $part \in PARTITIONS$
grd002: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$
grd003: $core \in CORES$
grd004: $finished\_core(core) = TRUE$

then

skip

end

Event set_partition_mode_to_idle ⟨ordinary⟩ $\widehat{=}$
extends set_partition_mode_to_idle

any

part
newm
procs
cores

where

grd001: $part \in PARTITIONS$

grd002: $newm \in PARTITION\_MODES$

grd101: $procs = processes\_of\_partition^{-1}[\{part\}]$

grd102: $cores \in \mathbb{P}_1\,(CORES)$

grd103: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$

grd104: $newm = PM\_IDLE$

grd105: $cores = Cores\_of\_Partition(part)$

grd106: $\forall core \cdot (core \in (Cores\_of\_Partition(part) \cap dom(finished\_core)) \Rightarrow finished\_core(core) = TRUE)$

grd202: $\forall core \cdot (core \in cores \land core \in dom(current\_processes) \land core \in dom(current\_processes\_flag))$

grd203: $current\_partition \in dom(current\_partition\_flag)$

grd201: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$

then

act001: $partition\_mode(part) := newm$

act101: $processes := processes \setminus procs$

act102: $process\_state := procs \mathbin{⩤} process\_state$

act103: $processes\_of\_partition := procs \mathbin{⩤} processes\_of\_partition$

act104: $processes\_of\_cores := procs \mathbin{⩤} processes\_of\_cores$

act201: $periodtype\_of\_process := procs \mathbin{⩤} periodtype\_of\_process$

act301: $process\_wait\_type := procs \mathbin{⩤} process\_wait\_type$

act302: $locklevel\_of\_partition(part) := 1$

act303: $basepriority\_of\_process := procs \mathbin{⩤} basepriority\_of\_process$

act304: $currentpriority\_of\_process := procs \mathbin{⩤} currentpriority\_of\_process$

act305: $retainedpriority\_of\_process := procs \mathbin{⩤} retainedpriority\_of\_process$

act306: $period\_of\_process := procs \mathbin{⩤} period\_of\_process$

act307: $timecapacity\_of\_process := procs \mathbin{⩤} timecapacity\_of\_process$

act308: $deadline\_of\_process := procs \mathbin{⩤} deadline\_of\_process$

act309: $deadlinetime\_of\_process := procs \mathbin{⩤} deadlinetime\_of\_process$

act310: $releasepoint\_of\_process := procs \mathbin{⩤} releasepoint\_of\_process$

act311: $delaytime\_of\_process := procs \mathbin{⩤} delaytime\_of\_process$

act312: $current\_partition\_flag(part) := FALSE$

act313: $current\_processes\_flag := current\_processes\_flag \mathbin{\lhd\!\!\!+} (cores \times \{FALSE\})$

act314: $preempter\_of\_partition := \{part\} \mathbin{⩤} preempter\_of\_partition$

act315: $preemption\_lock\_mutex := procs \mathbin{⩤} preemption\_lock\_mutex$

act316: $timeout\_trigger := procs \mathbin{⩤} timeout\_trigger$

act317: $errorhandler\_of\_partition := \{part\} \mathbin{⩤} errorhandler\_of\_partition$

act318: $process\_call\_errorhandler := procs \mathbin{⩤} process\_call\_errorhandler$

act319: $setnorm\_wait\_procs := cores \mathbin{⩤} setnorm\_wait\_procs$

act320: $setnorm\_susp\_procs := cores \mathbin{⩤} setnorm\_susp\_procs$

act321: $set\_priority\_parm := cores \mathbin{⩤} set\_priority\_parm$

act322: $suspend\_self\_timeout := cores \mathbin{⩤} suspend\_self\_timeout$

act323: $suspend\_self\_waitproc := cores \mathbin{⩤} suspend\_self\_waitproc$

act324: $resume\_proc := cores \mathbin{⩤} resume\_proc$

act325: $stop\_self\_proc := cores \mathbin{⩤} stop\_self\_proc$

act326: $stop\_proc := cores \mathbin{⩤} stop\_proc$

act327: $start\_aperiod\_proc := cores \mathbin{⩤} start\_aperiod\_proc$

act328: $start\_aperiod\_innormal\_proc := cores \mathbin{⩤} start\_aperiod\_innormal\_proc$

act329: $start\_period\_instart\_proc := cores \mathbin{⩤} start\_period\_instart\_proc$

act330: $start\_period\_innormal\_proc := cores \mathbin{⩤} start\_period\_innormal\_proc$

act331: $delay\_start\_ainstart\_proc := cores \mathbin{⩤} delay\_start\_ainstart\_proc$

act332: $delay\_start\_ainnormal\_proc := cores \mathbin{⩤} delay\_start\_ainnormal\_proc$

act333: $delay\_start\_ainnormal\_delaytime := cores \mathbin{⩤} delay\_start\_ainnormal\_delaytime$

act334: $delay\_start\_instart\_proc := cores \mathbin{⩤} delay\_start\_instart\_proc$

act335: $delay\_start\_innormal\_proc := cores \mathbin{⩤} delay\_start\_innormal\_proc$

act336: $delay\_start\_innormal\_delaytime := cores \mathbin{⩤} delay\_start\_innormal\_delaytime$

act337: $req\_busy\_resource\_proc := cores \mathbin{⩤} req\_busy\_resource\_proc$

act338: $resource\_become\_avail\_proc := cores \mathbin{⩤} resource\_become\_avail\_proc$

act339: $resource\_become\_avail2 := cores \lhd\!\!\!- resource\_become\_avail2$
act340: $time\_wait\_proc := cores \lhd\!\!\!- time\_wait\_proc$
act341: $period\_wait\_proc := cores \lhd\!\!\!- period\_wait\_proc$

end

Event set_partition_mode_to_coldstart ⟨ordinary⟩ $\widehat{=}$
extends set_partition_mode_to_coldstart

any

$part$
$newm$
$procs$
$cores$

where

grd001: $part \in PARTITIONS$
grd002: $newm \in PARTITION\_MODES$
grd101: $cores \in \mathbb{P}_1(CORES)$
grd102: $newm = PM\_COLD\_START$
grd103: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$
grd107: $part \in ran(processes\_of\_partition)$
grd104: $procs = processes\_of\_partition^{-1}[\{part\}]$
grd105: $cores = Cores\_of\_Partition(part)$
grd106: $\forall core \cdot (core \in (Cores\_of\_Partition(part) \cap dom(finished\_core)) \Rightarrow finished\_core(core) = TRUE)$
grd202: $\forall core \cdot (core \in cores \land core \in dom(current\_processes) \land core \in dom(current\_processes\_flag))$

grd201: $current\_partition \in dom(current\_partition\_flag)$
grd203: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$

then

act001: $partition\_mode(part) := newm$
act101: $processes := processes \setminus procs$
act102: $process\_state := procs \lhd\!\!\!- process\_state$
act103: $processes\_of\_partition := procs \lhd\!\!\!- processes\_of\_partition$
act104: $processes\_of\_cores := procs \lhd\!\!\!- processes\_of\_cores$
act201: $periodtype\_of\_process := procs \lhd\!\!\!- periodtype\_of\_process$
act301: $process\_wait\_type := procs \lhd\!\!\!- process\_wait\_type$
act302: $locklevel\_of\_partition(part) := 1$
act303: $basepriority\_of\_process := procs \lhd\!\!\!- basepriority\_of\_process$
act304: $currentpriority\_of\_process := procs \lhd\!\!\!- currentpriority\_of\_process$
act305: $retainedpriority\_of\_process := procs \lhd\!\!\!- retainedpriority\_of\_process$
act306: $period\_of\_process := procs \lhd\!\!\!- period\_of\_process$
act307: $timecapacity\_of\_process := procs \lhd\!\!\!- timecapacity\_of\_process$
act308: $deadline\_of\_process := procs \lhd\!\!\!- deadline\_of\_process$
act309: $deadlinetime\_of\_process := procs \lhd\!\!\!- deadlinetime\_of\_process$
act310: $releasepoint\_of\_process := procs \lhd\!\!\!- releasepoint\_of\_process$
act311: $delaytime\_of\_process := procs \lhd\!\!\!- delaytime\_of\_process$
act312: $current\_processes\_flag := current\_processes\_flag \lhd\!\!\!+ (cores \times \{FALSE\})$
act313: $preempter\_of\_partition := \{part\} \lhd\!\!\!- preempter\_of\_partition$
act314: $preemption\_lock\_mutex := procs \lhd\!\!\!- preemption\_lock\_mutex$
act315: $timeout\_trigger := procs \lhd\!\!\!- timeout\_trigger$
act316: $errorhandler\_of\_partition := \{part\} \lhd\!\!\!- errorhandler\_of\_partition$
act317: $process\_call\_errorhandler := procs \lhd\!\!\!- process\_call\_errorhandler$
act318: $setnorm\_wait\_procs := cores \lhd\!\!\!- setnorm\_wait\_procs$
act319: $setnorm\_susp\_procs := cores \lhd\!\!\!- setnorm\_susp\_procs$
act320: $set\_priority\_parm := cores \lhd\!\!\!- set\_priority\_parm$
act321: $suspend\_self\_timeout := cores \lhd\!\!\!- suspend\_self\_timeout$
act322: $suspend\_self\_waitproc := cores \lhd\!\!\!- suspend\_self\_waitproc$
act323: $resume\_proc := cores \lhd\!\!\!- resume\_proc$
act324: $stop\_self\_proc := cores \lhd\!\!\!- stop\_self\_proc$

act325: $stop\_proc := cores ⩤ stop\_proc$
act326: $start\_aperiod\_proc := cores ⩤ start\_aperiod\_proc$
act327: $start\_aperiod\_innormal\_proc := cores ⩤ start\_aperiod\_innormal\_proc$
act328: $start\_period\_instart\_proc := cores ⩤ start\_period\_instart\_proc$
act329: $start\_period\_innormal\_proc := cores ⩤ start\_period\_innormal\_proc$
act330: $delay\_start\_ainstart\_proc := cores ⩤ delay\_start\_ainstart\_proc$
act331: $delay\_start\_ainnormal\_proc := cores ⩤ delay\_start\_ainnormal\_proc$
act332: $delay\_start\_ainnormal\_delaytime := cores ⩤ delay\_start\_ainnormal\_delaytime$
act333: $delay\_start\_instart\_proc := cores ⩤ delay\_start\_instart\_proc$
act334: $delay\_start\_innormal\_proc := cores ⩤ delay\_start\_innormal\_proc$
act335: $delay\_start\_innormal\_delaytime := cores ⩤ delay\_start\_innormal\_delaytime$
act336: $req\_busy\_resource\_proc := cores ⩤ req\_busy\_resource\_proc$
act337: $resource\_become\_avail\_proc := cores ⩤ resource\_become\_avail\_proc$
act338: $resource\_become\_avail2 := cores ⩤ resource\_become\_avail2$
act339: $time\_wait\_proc := cores ⩤ time\_wait\_proc$
act340: $period\_wait\_proc := cores ⩤ period\_wait\_proc$

end

Event coldstart_partition_from_idle ⟨ordinary⟩ $\widehat{=}$

extends coldstart_partition_from_idle

any

$part$
$newm$
$cores$

where

grd001: $part \in PARTITIONS$
grd002: $newm \in PARTITION\_MODES$
grd101: $cores \in \mathbb{P}_1(CORES)$
grd102: $newm = PM\_COLD\_START$
grd103: $partition\_mode(part) = PM\_IDLE$
grd104: $cores = Cores\_of\_Partition(part)$
grd105: $\forall core \cdot (core \in (Cores\_of\_Partition(part) \cap dom(finished\_core)) \Rightarrow finished\_core(core) = TRUE)$

then

act001: $partition\_mode(part) := newm$
act201: $locklevel\_of\_partition(part) := 1$

end

Event set_partition_mode_to_warmstart ⟨ordinary⟩ $\widehat{=}$

extends set_partition_mode_to_warmstart

any

$part$
$newm$
$procs$
$cores$

where

grd001: $part \in PARTITIONS$
grd002: $newm \in PARTITION\_MODES$
grd101: $cores \in \mathbb{P}_1(CORES)$
grd102: $newm = PM\_WARM\_START$
grd103: $partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$
grd104: $procs = processes\_of\_partition^{-1}[\{part\}]$
grd105: $cores = Cores\_of\_Partition(part)$
grd106: $\forall core \cdot (core \in (Cores\_of\_Partition(part) \cap dom(finished\_core)) \Rightarrow finished\_core(core) = TRUE)$
grd203: $\forall core \cdot (core \in cores \land core \in dom(current\_processes) \land core \in dom(current\_processes\_flag))$

grd201: $current\_partition \in dom(current\_partition\_flag)$
grd202: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$

then

act001: $partition\_mode(part) := newm$
act101: $processes := processes \setminus procs$
act102: $process\_state := procs ⩤ process\_state$
act103: $processes\_of\_partition := procs ⩤ processes\_of\_partition$
act104: $processes\_of\_cores := procs ⩤ processes\_of\_cores$
act201: $periodtype\_of\_process := procs ⩤ periodtype\_of\_process$
act301: $process\_wait\_type := procs ⩤ process\_wait\_type$
act302: $locklevel\_of\_partition(part) := 1$
act303: $basepriority\_of\_process := procs ⩤ basepriority\_of\_process$
act304: $currentpriority\_of\_process := procs ⩤ currentpriority\_of\_process$
act305: $retainedpriority\_of\_process := procs ⩤ retainedpriority\_of\_process$
act306: $period\_of\_process := procs ⩤ period\_of\_process$
act307: $timecapacity\_of\_process := procs ⩤ timecapacity\_of\_process$
act308: $deadline\_of\_process := procs ⩤ deadline\_of\_process$
act309: $deadlinetime\_of\_process := procs ⩤ deadlinetime\_of\_process$
act310: $releasepoint\_of\_process := procs ⩤ releasepoint\_of\_process$
act311: $delaytime\_of\_process := procs ⩤ delaytime\_of\_process$
act312: $current\_processes\_flag := current\_processes\_flag \mathbin{<\!\!+} (cores \times \{FALSE\})$
act313: $preempter\_of\_partition := \{part\} ⩤ preempter\_of\_partition$
act314: $preemption\_lock\_mutex := procs ⩤ preemption\_lock\_mutex$
act315: $timeout\_trigger := procs ⩤ timeout\_trigger$
act316: $errorhandler\_of\_partition := \{part\} ⩤ errorhandler\_of\_partition$
act317: $process\_call\_errorhandler := procs ⩤ process\_call\_errorhandler$
act318: $setnorm\_wait\_procs := cores ⩤ setnorm\_wait\_procs$
act319: $setnorm\_susp\_procs := cores ⩤ setnorm\_susp\_procs$
act320: $set\_priority\_parm := cores ⩤ set\_priority\_parm$
act321: $suspend\_self\_timeout := cores ⩤ suspend\_self\_timeout$
act322: $suspend\_self\_waitproc := cores ⩤ suspend\_self\_waitproc$
act323: $resume\_proc := cores ⩤ resume\_proc$
act324: $stop\_self\_proc := cores ⩤ stop\_self\_proc$
act325: $stop\_proc := cores ⩤ stop\_proc$
act326: $start\_aperiod\_proc := cores ⩤ start\_aperiod\_proc$
act327: $start\_aperiod\_innormal\_proc := cores ⩤ start\_aperiod\_innormal\_proc$
act328: $start\_period\_instart\_proc := cores ⩤ start\_period\_instart\_proc$
act329: $start\_period\_innormal\_proc := cores ⩤ start\_period\_innormal\_proc$
act330: $delay\_start\_ainstart\_proc := cores ⩤ delay\_start\_ainstart\_proc$
act331: $delay\_start\_ainnormal\_proc := cores ⩤ delay\_start\_ainnormal\_proc$
act332: $delay\_start\_ainnormal\_delaytime := cores ⩤ delay\_start\_ainnormal\_delaytime$
act333: $delay\_start\_instart\_proc := cores ⩤ delay\_start\_instart\_proc$
act334: $delay\_start\_innormal\_proc := cores ⩤ delay\_start\_innormal\_proc$
act335: $delay\_start\_innormal\_delaytime := cores ⩤ delay\_start\_innormal\_delaytime$
act336: $req\_busy\_resource\_proc := cores ⩤ req\_busy\_resource\_proc$
act337: $resource\_become\_avail\_proc := cores ⩤ resource\_become\_avail\_proc$
act338: $resource\_become\_avail2 := cores ⩤ resource\_become\_avail2$
act339: $time\_wait\_proc := cores ⩤ time\_wait\_proc$
act340: $period\_wait\_proc := cores ⩤ period\_wait\_proc$

end

Event warmstart_partition_from_idle ⟨ordinary⟩ $\widehat{=}$
extends warmstart_partition_from_idle

any

$part$
$newm$
$cores$

where

grd001: $part \in PARTITIONS$
grd002: $newm \in PARTITION\_MODES$
grd101: $cores \in \mathbb{P}_1(CORES)$
grd102: $newm = PM\_WARM\_START$
grd103: $partition\_mode(part) = PM\_IDLE$

grd104: $cores = Cores\_of\_Partition(part)$
grd105: $\forall core\cdot(core \in (Cores\_of\_Partition(part) \cap dom(finished\_core)) \Rightarrow finished\_core(core) = TRUE)$

then

act001: $partition\_mode(part) := newm$
act201: $locklevel\_of\_partition(part) := 1$

end

Event set_partition_mode_to_normal_init' ⟨ordinary⟩ $\widehat{=}$
extends set_partition_mode_to_normal_init

any

part
core
service

where

grd001: $part \in PARTITIONS$
grd002: $core \in CORES$
grd003: $service \in Services$
grd004: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd005: $finished\_core(core) = TRUE$
grd006: $service = Set\_Normal$
grd201: $part \in dom(current\_partition\_flag) \land current\_partition = part \land current\_partition\_flag(part) = TRUE$

then

act001: $location\_of\_service(core) := service \mapsto loc\_i$
act002: $finished\_core(core) := FALSE$
act201: $location\_of\_service2(core) := service \mapsto loc\_i$

end

Event set_partition_mode_to_normal_mode' ⟨ordinary⟩ $\widehat{=}$
extends set_partition_mode_to_normal_mode

any

part
newm
core

where

grd001: $part \in PARTITIONS$
grd002: $newm \in PARTITION\_MODES$
grd101: $core \in CORES \cap dom(location\_of\_service)$
grd102: $newm = PM\_NORMAL$
grd103: $finite(processes\_of\_partition^{-1}[\{part\}]) \land card(processes\_of\_partition^{-1}[\{part\}]) > 0$
grd104: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd105: $location\_of\_service(core) = Set\_Normal \mapsto loc\_i$
grd106: $finished\_core(core) = FALSE$
grd201: $location\_of\_service2(core) = Set\_Normal \mapsto loc\_i$
grd203: $current\_partition = part \land current\_partition\_flag(part) = TRUE$

then

act001: $location\_of\_service(core) := Set\_Normal \mapsto loc\_1$
act002: $partition\_mode(part) := newm$
act201: $location\_of\_service2(core) := Set\_Normal \mapsto loc\_1$

end

Event set_partition_mode_to_normal_ready'_and_fst_point ⟨ordinary⟩ $\widehat{=}$
extends set_partition_mode_to_normal_ready

any

part
procs
procs2
procsstate

$core$
nrlt
stperprocs
dstperprocs
staperprocs
dstaperprocs

where

grd001: $part \in PARTITIONS$
grd002: $partition\_mode(part) = PM\_NORMAL$
grd003: $procs = processes\_of\_partition^{-1}[\{part\}] \cap process\_state^{-1}[\{PS\_Waiting\}]$
grd004: $procs2 = processes\_of\_partition^{-1}[\{part\}] \cap process\_state^{-1}[\{PS\_WaitandSuspend\}]$
grd005: $procsstate \in procs \rightarrow \{PS\_Waiting, PS\_Ready\}$
grd006: $core \in CORES \cap dom(location\_of\_service)$
grd007: $location\_of\_service(core) = Set\_Normal \mapsto loc\_1$
grd008: $finished\_core(core) = FALSE$
grd201: $current\_partition = part \land current\_partition\_flag(part) = TRUE$
grd202: $part \in ran(processes\_of\_partition)$
grd203: $stperprocs = (procs \setminus period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}]) \cap process\_wait\_type^{-1}[\{PROC$

grd204: $dstperprocs = (procs \setminus period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}]) \cap process\_wait\_type^{-1}[\{PROC$

grd205: $staperprocs = procs \cap period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}] \cap process\_wait\_type^{-1}[\{PROC$

grd206: $dstaperprocs = procs \cap period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}] \cap process\_wait\_type^{-1}[\{PROC$

grd207: $nrlt \in stperprocs \rightarrow \mathbb{N}$
grd208: $\forall p, x, y, b \cdot (p \in stperprocs \land ((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow nrlt(p) = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x)$
grd209: $procsstate = (staperprocs \times \{PS\_Ready\}) \cup ((dstaperprocs \cup stperprocs \cup dstperprocs) \times \{PS\_Waiting\})$
grd210: $location\_of\_service2(core) = Set\_Normal \mapsto loc\_1$

then

act001: $location\_of\_service(core) := Set\_Normal \mapsto loc\_2$
act002: $process\_state := (process\_state \mathbin{<\!\!+} procsstate) \mathbin{<\!\!+} (procs2 \times \{PS\_Suspend\})$
act201: $location\_of\_service2(core) := Set\_Normal \mapsto loc\_2$
act202: $setnorm\_wait\_procs(core) := procs$
act203: $setnorm\_susp\_procs(core) := procs2$
act204: $releasepoint\_of\_process := releasepoint\_of\_process \mathbin{<\!\!+} nrlt$

end

Event set_partition_mode_to_normal_release_point_and_frstpoint2 ⟨ordinary⟩ $\widehat{=}$

any

part
core
procs
rlt
nrlt
dstperprocs
dstaperprocs

where

grd001: $part \in PARTITIONS$
grd002: $partition\_mode(part) = PM\_NORMAL$
grd003: $core \in CORES$
grd004: $core \in dom(setnorm\_wait\_procs) \land procs = setnorm\_wait\_procs(core)$
grd006: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_2$
grd007: $finished\_core(core) = FALSE$
grd009: $current\_partition = part \land current\_partition\_flag(part) = TRUE$
grd010: $dstperprocs = (procs \setminus period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}]) \cap process\_wait\_type^{-1}[\{PROC$

grd011: $dstaperprocs = procs \cap period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}] \cap process\_wait\_type^{-1}[\{PROC$

grd012: $rlt \in dstaperprocs \rightarrow \mathbb{N}$

grd013: $\forall p \cdot (p \in dstaperprocs \Rightarrow rlt(p) = clock\_tick * ONE\_TICK\_TIME + delaytime\_of\_process(p))$

grd014: $nrlt \in dstperprocs \rightarrow \mathbb{N}$

grd015: $\forall p, x, y, b \cdot (p \in dstperprocs \land ((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow nrlt(p) = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x + delaytime\_of\_process(p))$

then

act001: $location\_of\_service2(core) := Set\_Normal \mapsto loc\_3$

act002: $releasepoint\_of\_process := releasepoint\_of\_process \mathbin{<\!\!\!+} rlt \mathbin{<\!\!\!+} nrlt$

end

Event set_partition_mode_to_normal_deadlinetime ⟨ordinary⟩ $\widehat{=}$

any

part
core
procs
staperprocs
dstaperprocs
suspaperprocs
stperprocs
dstperprocs
dl1
dl2
dl3
dl4

where

grd001: $part \in PARTITIONS$

grd002: $partition\_mode(part) = PM\_NORMAL$

grd003: $core \in CORES$

grd004: $core \in dom(setnorm\_wait\_procs) \land procs = setnorm\_wait\_procs(core)$

grd005: $core \in dom(setnorm\_susp\_procs) \land suspaperprocs = setnorm\_susp\_procs(core)$

grd006: $staperprocs = procs \cap period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}] \cap process\_wait\_type^{-1}[\{PROC$

grd007: $dstaperprocs = procs \cap period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}] \cap process\_wait\_type^{-1}[\{PROC$

grd008: $stperprocs = (procs \setminus period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}]) \cap process\_wait\_type^{-1}[\{PROC$

grd009: $dstperprocs = (procs \setminus period\_of\_process^{-1}[\{INFINITE\_TIME\_VALUE\}]) \cap process\_wait\_type^{-1}[\{PROC$

grd010: $dl1 \in staperprocs \cup suspaperprocs \rightarrow \mathbb{N}$

grd011: $\forall p \cdot (p \in staperprocs \cup suspaperprocs \land p \in dom(timecapacity\_of\_process) \Rightarrow dl1(p) = clock\_tick * ONE\_TICK\_TIME + timecapacity\_of\_process(p))$

grd012: $dl2 \in dstaperprocs \rightarrow \mathbb{N}$

grd013: $\forall p \cdot (p \in dstaperprocs \land p \in dom(delaytime\_of\_process) \land p \in dom(timecapacity\_of\_process) \Rightarrow dl2(p) = clock\_tick * ONE\_TICK\_TIME + delaytime\_of\_process(p) + timecapacity\_of\_process(p))$

grd014: $dl3 \in stperprocs \rightarrow \mathbb{N}$

grd015: $\forall p \cdot (p \in stperprocs \land p \in dom(timecapacity\_of\_process) \Rightarrow dl3(p) = clock\_tick * ONE\_TICK\_TIME + timecapacity\_of\_process(p))$

grd016: $dl4 \in dstperprocs \rightarrow \mathbb{N}$

grd017: $\forall p \cdot (p \in dstperprocs \land p \in dom(delaytime\_of\_process) \land p \in dom(timecapacity\_of\_process) \Rightarrow dl4(p) = clock\_tick * ONE\_TICK\_TIME + delaytime\_of\_process(p) + timecapacity\_of\_process(p))$

grd018: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_3$

grd019: $finished\_core(core) = FALSE$

then

act001: $location\_of\_service2(core) := Set\_Normal \mapsto loc\_4$

act002: $deadlinetime\_of\_process := deadlinetime\_of\_process \mathbin{<\!\!\!+} dl1 \mathbin{<\!\!\!+} dl2 \mathbin{<\!\!\!+} dl3 \mathbin{<\!\!\!+} dl4$

end

Event set_partition_mode_to_normal_locklevel ⟨ordinary⟩ $\widehat{=}$

any

part

core

where

grd001: $part \in PARTITIONS$

grd002: $partition\_mode(part) = PM\_NORMAL$

grd003: $core \in CORES$

grd004: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Normal \mapsto loc\_4$

grd005: $finished\_core(core) = FALSE$

then

act001: $location\_of\_service2(core) := Set\_Normal \mapsto loc\_5$

act002: $locklevel\_of\_partition(part) := 0$

act003: $preempter\_of\_partition := \{part\} ⩤ preempter\_of\_partition$

act004: $timeout\_trigger := (processes\_of\_partition^{-1}[\{part\}]) ⩤ timeout\_trigger$

end

Event set_partition_mode_to_normal_return' ⟨ordinary⟩ $\widehat{=}$

extends set_partition_mode_to_normal_return

any

part

core

where

grd001: $part \in PARTITIONS$

grd002: $partition\_mode(part) = PM\_NORMAL$

grd003: $core \in CORES \cap dom(location\_of\_service)$

grd004: $location\_of\_service(core) = Set\_Normal \mapsto loc\_2$

grd005: $finished\_core(core) = FALSE$

then

act001: $location\_of\_service(core) := Set\_Normal \mapsto loc\_r$

act002: $finished\_core(core) := TRUE$

end

Event get_process_id ⟨ordinary⟩ $\widehat{=}$

any

proc

core

where

grd001: $proc \in processes$

grd002: $proc \in dom(processes\_of\_partition) \land processes\_of\_partition(proc) = current\_partition$

grd003: $current\_partition \in dom(current\_partition\_flag) \land current\_partition\_flag(current\_partition) = TRUE$

grd004: $core \in CORES$

grd005: $finished\_core(core) = TRUE$

then

skip

end

Event get_process_status ⟨ordinary⟩ $\widehat{=}$

any

proc

core

where

grd001: $proc \in processes$

grd002: $proc \in dom(processes\_of\_partition) \land processes\_of\_partition(proc) = current\_partition$

grd003: $current\_partition \in dom(current\_partition\_flag) \land current\_partition\_flag(current\_partition) = TRUE$

grd004: $core \in CORES$

grd005: $finished\_core(core) = TRUE$

then

skip

end

Event create_process_init ⟨ordinary⟩ $\widehat{=}$
extends create_process_init
  any
    $part$
    $proc$
    $core$
    $service$
    $ptype$
    period
    timecapacity
    basepriority
    dl
  where
    grd001: $part \in PARTITIONS$
    grd002: $proc \in (PROCESSES \setminus processes)$
    grd003: $core \in CORES$
    grd004: $service \in Services$
    grd005: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

    grd006: $finished\_core(core) = TRUE$
    grd007: $service = Create\_Process$
    grd101: $ptype \in PROC\_PERIOD\_TYPE$
    grd201: $current\_partition = part$
    grd202: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
    grd203: $period \in \mathbb{N}$
    grd204: $timecapacity \in \mathbb{N}$
    grd205: $basepriority \in MIN\_PRIORITY \mathrel{..} MAX\_PRIORITY$
    grd206: $dl \in DEADLINE\_TYPE$
    grd207: $part \in dom(Period\_of\_Partition) \land period \neq INFINITE\_TIME\_VALUE \Rightarrow (\exists n \cdot (n \in \mathbb{N} \land period = n * Period\_of\_Partition(part)))$
    grd208: $period \neq INFINITE\_TIME\_VALUE \Rightarrow (timecapacity \leq period)$
    grd209: $(ptype = APERIOD\_PROC \Leftrightarrow period = INFINITE\_TIME\_VALUE)$
    grd210: $(ptype = PERIOD\_PROC \Leftrightarrow period > 0)$
  then
    act001: $location\_of\_service(core) := service \mapsto loc\_i$
    act002: $finished\_core(core) := FALSE$
    act003: $processes := processes \cup \{proc\}$
    act004: $processes\_of\_partition(proc) := part$
    act005: $create\_process\_parm(core) := proc$
    act101: $periodtype\_of\_process(proc) := ptype$
    act201: $period\_of\_process(proc) := period$
    act202: $timecapacity\_of\_process(proc) := timecapacity$
    act203: $basepriority\_of\_process(proc) := basepriority$
    act204: $deadline\_of\_process(proc) := dl$
    act205: $currentpriority\_of\_process(proc) := basepriority$
    act206: $retainedpriority\_of\_process(proc) := basepriority$
    act207: $preemption\_lock\_mutex(proc) := FALSE$
  end

Event create_process_dormant ⟨ordinary⟩ $\widehat{=}$
extends create_process_dormant
  any
    $part$
    $proc$
    $core$
  where
    grd001: $part \in PARTITIONS$
    grd002: $proc \in processes$
    grd003: $core \in CORES \cap dom(location\_of\_service)$
    grd004: $location\_of\_service(core) = Create\_Process \mapsto loc\_i$

```
          grd005:  $finished\_core(core) = FALSE$
          grd007:  $proc = create\_process\_parm(core)$
          grd008:  $processes\_of\_partition(proc) = part$
          grd009:  $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

          grd201:  $current\_partition = part$
          grd202:  $current\_partition\_flag(part) = TRUE$
     then
          act001: $location\_of\_service(core) := Create\_Process \mapsto loc\_1$
          act002: $process\_state(proc) := PS\_Dormant$
     end
Event create_process_core ⟨ordinary⟩ $\widehat{=}$
extends create_process_core
     any
          $part$
          $proc$
          $core$
     where
          grd001:  $part \in PARTITIONS$
          grd002:  $proc \in processes$
          grd003:  $core \in CORES \cap dom(location\_of\_service)$
          grd004:  $location\_of\_service(core) = Create\_Process \mapsto loc\_1$
          grd005:  $finished\_core(core) = FALSE$
          grd007:  $processes\_of\_partition(proc) = part$
          grd008:  $process\_state(proc) = PS\_Dormant$
          grd009:  $create\_process\_parm(core) = proc$
          grd010:  $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

          grd201:  $current\_partition = part$
          grd202:  $current\_partition\_flag(part) = TRUE$
     then
          act001: $location\_of\_service(core) := Create\_Process \mapsto loc\_2$
          act002: $processes\_of\_cores(proc) := core$
     end
Event create_process_return ⟨ordinary⟩ $\widehat{=}$
extends create_process_return
     any
          $part$
          $proc$
          $core$
     where
          grd001:  $part \in PARTITIONS$
          grd002:  $proc \in processes$
          grd003:  $core \in CORES \cap dom(location\_of\_service)$
          grd004:  $location\_of\_service(core) = Create\_Process \mapsto loc\_2$
          grd005:  $finished\_core(core) = FALSE$
          grd007:  $processes\_of\_partition(proc) = part$
          grd008:  $process\_state(proc) = PS\_Dormant$
          grd009:  $create\_process\_parm(core) = proc$
          grd010:  $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

          grd201:  $current\_partition = part$
          grd202:  $current\_partition\_flag(part) = TRUE$
     then
          act001: $location\_of\_service(core) := Create\_Process \mapsto loc\_r$
          act002: $finished\_core(core) := TRUE$
          act003: $create\_process\_parm := \{core\} ⩤ create\_process\_parm$
     end
Event set_priority_init ⟨ordinary⟩ $\widehat{=}$
```

any

part
proc
core
pri

where

grd001: $part \in PARTITIONS$
grd002: $current\_partition = part$
grd003: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
grd004: $proc \in processes$
grd005: $core \in CORES$
grd006: $finished\_core2(core) = TRUE$
grd007: $proc \in dom(process\_state) \land process\_state(proc) \neq PS\_Dormant$
grd008: $proc \in processes\_of\_partition^{-1}[\{part\}]$
grd009: $pri \in MIN\_PRIORITY \mathrel{..} MAX\_PRIORITY$

then

act001: $location\_of\_service2(core) := Set\_Priority \mapsto loc\_i$
act002: $finished\_core2(core) := FALSE$
act003: $set\_priority\_parm(core) := pri$

end

Event set_priority_owned_preemption ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $current\_partition = part$
grd003: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
grd004: $proc \in processes$
grd005: $core \in CORES \cap dom(set\_priority\_parm)$
grd006: $finished\_core2(core) = FALSE$
grd007: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_i$
grd009: $process\_state(proc) \neq PS\_Dormant$
grd010: $preemption\_lock\_mutex(proc) = TRUE$
owned a mutex

then

act001: $location\_of\_service2(core) := Set\_Priority \mapsto loc\_1$
act002: $retainedpriority\_of\_process(proc) := set\_priority\_parm(core)$

end

Event set_priority_notowned_preemption ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $current\_partition = part$
grd003: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
grd004: $proc \in processes$
grd005: $core \in CORES \cap dom(set\_priority\_parm)$
grd006: $finished\_core2(core) = FALSE$
grd007: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_i$
grd008: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_i)$
grd009: $process\_state(proc) \neq PS\_Dormant$
grd010: $preemption\_lock\_mutex(proc) = FALSE$
not owned a mutex

then

act001: $location\_of\_service2(core) := Set\_Priority \mapsto loc\_1$

act002: $currentpriority\_of\_process(proc) := set\_priority\_parm(core)$

end

Event set_priority_check_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part
core
needproc

where

grd001: $part \in PARTITIONS$
grd002: $current\_partition = part$
grd003: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
grd004: $core \in CORES$
grd005: $needproc \in BOOL$
grd006: $part \in dom(locklevel\_of\_partition) \land locklevel\_of\_partition(part) = 0 \Rightarrow needproc = TRUE$
grd007: $part \in dom(locklevel\_of\_partition) \land locklevel\_of\_partition(part) \neq 0 \Rightarrow needproc = need\_reschedule$
grd008: $finished\_core2(core) = FALSE$
grd009: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_1$
grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Set\_Priority \mapsto loc\_2$
act002: $need\_reschedule := needproc$

end

Event set_priority_return ⟨ordinary⟩ $\widehat{=}$

any

part
core
proc

where

grd001: $part \in PARTITIONS$
grd002: $current\_partition = part$
grd003: $part \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$
grd004: $core \in CORES$
grd005: $proc \in processes$
grd006: $proc \in dom(process\_state) \land process\_state(proc) \neq PS\_Dormant$
grd007: $finished\_core2(core) = FALSE$
grd008: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Set\_Priority \mapsto loc\_2$

then

act001: $location\_of\_service2(core) := Set\_Priority \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $set\_priority\_parm := \{core\} \triangleleft set\_priority\_parm$

end

Event suspend_self_init ⟨ordinary⟩ $\widehat{=}$

refines suspend_self

any

part
proc
newstate
core
timeout

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process) \land proc \in ran(current\_processes)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running$

grd103: $newstate = PS\_Suspend$

grd104: $periodtype\_of\_process(proc) = APERIOD\_PROC$

grd201: $timeout \in \mathbb{Z} \land timeout \neq 0$

grd202: $part = current\_partition$

grd211: $core \in current\_processes^{-1}[\{proc\}] \land core \in dom(current\_processes\_flag)$

grd213: $core \in dom(current\_processes)$

grd209: $part \in dom(current\_partition\_flag)$

grd214: $current\_partition\_flag(part) = TRUE$

grd204: $current\_processes\_flag(core) = TRUE$

grd203: $proc = current\_processes(core)$

grd205: $part \in dom(errorhandler\_of\_partition) \Rightarrow proc \neq errorhandler\_of\_partition(part)$

grd210: $part \in dom(locklevel\_of\_partition)$

grd206: $locklevel\_of\_partition(part) = 0$

grd212: $proc \in dom(preemption\_lock\_mutex)$

grd207: $preemption\_lock\_mutex(proc) = FALSE$

then

act001: $process\_state(proc) := newstate$

act101: $location\_of\_service2(core) := Suspend\_self \mapsto loc\_i$

act102: $finished\_core2(core) := FALSE$

act103: $suspend\_self\_timeout(core) := timeout$

act104: $suspend\_self\_waitproc(core) := proc$

act105: $current\_processes\_flag(core) := FALSE$

act106: $current\_processes := \{core\} \mathbin{\lhd\mkern-14mu-} current\_processes$

end

Event suspend_self_timeout ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

timeout

timeouttrig

waittype

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes$

grd003: $partition\_mode(part) = PM\_NORMAL$

grd004: $proc \in dom(processes\_of\_partition) \land processes\_of\_partition(proc) = part$

grd005: $core \in CORES$

grd006: $timeout \in \mathbb{Z} \land timeout \neq 0$

grd007: $core \in dom(suspend\_self\_timeout) \land core \in dom(current\_processes\_flag)$

grd008: $part = current\_partition$

grd010: $part \in dom(errorhandler\_of\_partition) \Rightarrow proc \neq errorhandler\_of\_partition(part)$

grd011: $processes\_of\_partition(proc) \in dom(locklevel\_of\_partition) \land locklevel\_of\_partition(part) = 0$

grd012: $finished\_core2(core) = FALSE$

grd013: $core \in dom(location\_of\_service2) \land location\_of\_service2(core) = Suspend\_self \mapsto loc\_i$

grd014: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Suspend\_self \mapsto loc\_i)$

grd015: $timeout = suspend\_self\_timeout(core)$

grd016: $timeouttrig \in processes \mathrel{+\!\!\!\!\to} (PROCESS\_STATES \times \mathbb{N}_1)$

grd020: $proc = suspend\_self\_waitproc(core)$

grd017: $timeout \neq INFINITE\_TIME\_VALUE \land timeout \neq 0 \Rightarrow timeouttrig = \{proc \mapsto (PS\_Ready \mapsto (timeout + clock\_tick * ONE\_TICK\_TIME))\}$

grd018: $timeout = INFINITE\_TIME\_VALUE \Rightarrow timeouttrig = \varnothing$

grd019: $waittype \in processes \mathrel{+\!\!\!\!\to} PROCESS\_WAIT\_TYPES$

grd021: $timeout > 0 \Rightarrow waittype = \{proc \mapsto PROC\_WAIT\_TIMEOUT\}$

grd022: $(timeout = INFINITE\_TIME\_VALUE \lor timeout = 0) \Rightarrow waittype = \varnothing$

then

act001: $location\_of\_service2(core) := Suspend\_self \mapsto loc\_1$

act002: $timeout\_trigger := timeout\_trigger \mathbin{\lhd\!\!\!+} timeouttrig$

act003: $process\_wait\_type := process\_wait\_type \mathbin{\lhd\!\!\!+} waittype$

end

Event suspend_self_ask_schedule ⟨ordinary⟩ $\widehat{=}$

any

part

core

timeout

needresch

where

grd001: $part \in PARTITIONS$

grd002: $part = current\_partition$

grd003: $partition\_mode(part) = PM\_NORMAL$

grd004: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(current\_processes\_flag)$

grd005: $core \in dom(suspend\_self\_timeout)$

grd007: $timeout \in \mathbb{Z} \land timeout \neq 0$

grd008: $timeout = suspend\_self\_timeout(core)$

grd010: $needresch \in BOOL$

grd012: $(timeout = 0 \Rightarrow needresch = FALSE) \land (timeout > 0 \Rightarrow needresch = TRUE)$

grd014: $finished\_core2(core) = FALSE$

grd015: $location\_of\_service2(core) = Suspend\_self \mapsto loc\_1$

grd016: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Suspend\_self \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Suspend\_self \mapsto loc\_2$

act003: $need\_reschedule := needresch$

end

Event suspend_self_return ⟨ordinary⟩ $\widehat{=}$

any

part

core

where

grd001: $part \in PARTITIONS$

grd002: $part = current\_partition$

grd003: $partition\_mode(part) = PM\_NORMAL$

grd004: $core \in CORES \land core \in dom(location\_of\_service2)$

grd005: $core \in dom(suspend\_self\_timeout) \land core \in dom(suspend\_self\_waitproc)$

grd006: $finished\_core2(core) = FALSE$

grd007: $location\_of\_service2(core) = Suspend\_self \mapsto loc\_2$

grd008: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Suspend\_self \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Suspend\_self \mapsto loc\_r$

act002: $finished\_core2(core) := TRUE$

act003: $suspend\_self\_timeout := \{core\} \mathbin{\lhd\!\!\!-} suspend\_self\_timeout$

act004: $suspend\_self\_waitproc := \{core\} \mathbin{\lhd\!\!\!-} suspend\_self\_waitproc$

end

Event suspend ⟨ordinary⟩ $\widehat{=}$

refines suspend

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$

grd017: $finished\_core(core) = TRUE$

grd101: $partition\_mode(part) = PM\_NORMAL \Rightarrow (process\_state(proc) = PS\_Ready \land newstate = PS\_Suspend) \lor (process\_state(proc) = PS\_Waiting \land newstate = PS\_WaitandSuspend)$

grd102: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \Rightarrow (process\_state(proc) = PS\_Waiting \land newstate = PS\_WaitandSuspend)$

grd103: $periodtype\_of\_process(proc) = APERIOD\_PROC$

grd201: $part = current\_partition$

grd202: $processes\_of\_partition(proc) \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE \land current\_processes\_flag(core) = TRUE$

grd203: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$

grd204: $processes\_of\_partition(proc) \in dom(locklevel\_of\_partition) \land (locklevel\_of\_partition(part) = 0 \lor proc \notin ran(process\_call\_errorhandler))$

grd205: $proc \in dom(period\_of\_process) \land period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

grd206: $process\_state(proc) \neq PS\_Dormant$

grd207: $process\_state(proc) \neq PS\_Suspend \land process\_state(proc) \neq PS\_WaitandSuspend$

grd208: $proc \in dom(preemption\_lock\_mutex) \land preemption\_lock\_mutex(proc) = FALSE$

grd209: $process\_state(proc) \neq PS\_Faulted$

then

act001: $process\_state(proc) := newstate$

end

Event resume_init ⟨ordinary⟩ $\widehat{=}$

refines resume

any

part
proc
newstate
core
trigs

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd208: $proc \in dom(timeout\_trigger)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$

grd017: $finished\_core2(core) = TRUE$

grd101: $partition\_mode(part) = PM\_NORMAL \Rightarrow (process\_state(proc) = PS\_Suspend \land newstate = PS\_Ready) \lor (process\_state(proc) = PS\_WaitandSuspend \land newstate = PS\_Waiting)$

grd102: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \Rightarrow (process\_state(proc) = PS\_WaitandSuspend \land newstate = PS\_Waiting)$

grd103: $periodtype\_of\_process(proc) = APERIOD\_PROC$

grd201: $current\_partition = part$

grd202: $processes\_of\_partition(proc) \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$

grd203: $current\_processes\_flag(core) = TRUE \Rightarrow proc \in ran(current\_processes)$

grd204: $process\_state(proc) \neq PS\_Dormant$

grd205: $process\_state(proc) = PS\_Suspend \Rightarrow newstate = PS\_Ready$

grd206: $process\_state(proc) = PS\_WaitandSuspend \Rightarrow newstate = PS\_Waiting$

grd207: $process\_state(proc) \neq PS\_Faulted$

grd209: $newstate = PS\_Ready \Rightarrow trigs = \{proc\}$

grd210: $newstate = PS\_Waiting \Rightarrow trigs = \varnothing$

then

act001: $process\_state(proc) := newstate$

act201: $location\_of\_service2(core) := Resume \mapsto loc\_i$

act202: $finished\_core2(core) := FALSE$

act203: $resume\_proc(core) := proc$

act204: $timeout\_trigger := trigs \lhd timeout\_trigger$

end

Event resume_check_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

reschedule

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in ran(resume\_proc) \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \land core \in dom(resume\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $current\_partition = part$

grd006: $processes\_of\_partition(proc) \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$

grd014: $proc = resume\_proc(core)$

grd007: $reschedule \in BOOL$

grd015: $resume\_proc(core) \in dom(process\_state) \land processes\_of\_partition(resume\_proc(core)) \in dom(locklevel\_of\_partition)$

grd008: $locklevel\_of\_partition(part) = 0 \land process\_state(proc) = PS\_Ready \Rightarrow reschedule = TRUE$

grd009: $(locklevel\_of\_partition(part) > 0) \land (process\_state(proc) = PS\_Waiting \Rightarrow reschedule = need\_reschedule)$

grd010: $current\_processes\_flag(core) = TRUE \Rightarrow proc \in ran(current\_processes)$

grd011: $finished\_core2(core) = FALSE$

grd012: $location\_of\_service2(core) = Resume \mapsto loc\_i$

grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resume \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Resume \mapsto loc\_1$

act002: $need\_reschedule := reschedule$

end

Event resume_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in ran(resume\_proc)$

grd003: $core \in CORES \land core \in dom(resume\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = resume\_proc(core)$

grd012: $resume\_proc(core) \in dom(processes\_of\_partition)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd007: $processes\_of\_partition(resume\_proc(core)) \in dom(current\_partition\_flag) \land current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Resume \mapsto loc\_1$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resume \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Resume \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $resume\_proc := \{core\} \lhd resume\_proc$

end

Event stop_self_init ⟨ordinary⟩ $\widehat{=}$
refines stop_self

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd101: $partition\_mode(part) = PM\_NORMAL$
grd102: $process\_state(proc) = PS\_Running \land newstate = PS\_Dormant$
grd201: $current\_partition = part$
grd205: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd202: $current\_partition\_flag(part) = TRUE$
grd203: $current\_processes\_flag(core) = TRUE$
grd204: $proc \in ran(current\_processes)$

then

act001: $process\_state(proc) := newstate$
act201: $location\_of\_service2(core) := Stop\_self \mapsto loc\_i$
act202: $finished\_core2(core) := FALSE$
act203: $stop\_self\_proc(core) := proc$
act204: $timeout\_trigger := \{proc\} \lhd timeout\_trigger$
act205: $current\_processes\_flag(core) := FALSE$
act206: $current\_processes := \{core\} \lhd current\_processes$

end

Event stop_self_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
reschedule

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$
grd003: $core \in (CORES \cap dom(stop\_self\_proc)) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $part = current\_partition$
grd006: $proc = stop\_self\_proc(core)$
grd014: $processes\_of\_partition(stop\_self\_proc(core)) \in dom(current\_partition\_flag) \land processes\_of\_partition(stop\_s$
$dom(locklevel\_of\_partition)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $reschedule \in BOOL$
grd015: $stop\_self\_proc(core) \in dom(process\_call\_errorhandler) \land process\_call\_errorhandler(stop\_self\_proc(core)) \in$
$dom(process\_state)$
grd009:
$part \in dom(errorhandler\_of\_partition) \land proc = errorhandler\_of\_partition(part) \land locklevel\_of\_partition(part) >$
0
$\land process\_state(process\_call\_errorhandler(proc)) \neq PS\_Dormant \Rightarrow reschedule = FALSE$
grd010:
$\neg(part \in dom(errorhandler\_of\_partition) \land proc = errorhandler\_of\_partition(part) \land locklevel\_of\_partition(part)$

0

$\land process\_state(process\_call\_errorhandler(proc)) \neq PS\_Dormant) \Rightarrow reschedule = TRUE$

grd011: $finished\_core2(core) = FALSE$

grd012: $location\_of\_service2(core) = Stop\_self \mapsto loc\_i$

grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop\_self \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Stop\_self \mapsto loc\_1$

act002: $need\_reschedule := reschedule$

end

Event stop_self_return_no_mutex ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in (processes \cap ran(stop\_self\_proc))$

grd003: $core \in (CORES \cap dom(stop\_self\_proc)) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = stop\_self\_proc(core)$

grd013: $stop\_self\_proc(core) \in dom(processes\_of\_partition) \land processes\_of\_partition(stop\_self\_proc(core)) \in dom(current\_partition\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd007: $current\_partition\_flag(part) = TRUE$

grd014: $stop\_self\_proc(core) \in dom(preemption\_lock\_mutex)$

grd012: $preemption\_lock\_mutex(proc) = FALSE$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Stop\_self \mapsto loc\_1$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop\_self \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Stop\_self \mapsto loc\_r$

act002: $finished\_core2(core) := TRUE$

act003: $stop\_self\_proc := \{core\} \lhd\!\!\!- stop\_self\_proc$

end

Event stop_self_mutex_zero ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in (processes \cap ran(stop\_self\_proc))$

grd003: $core \in (CORES \cap dom(stop\_self\_proc)) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = stop\_self\_proc(core)$

grd014: $stop\_self\_proc(core) \in dom(processes\_of\_partition) \land processes\_of\_partition(stop\_self\_proc(core)) \in dom(current\_partition\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd013: $proc \notin ran(errorhandler\_of\_partition)$

grd007: $current\_partition\_flag(part) = TRUE$

grd015: $stop\_self\_proc(core) \in dom(preemption\_lock\_mutex)$

grd009: $preemption\_lock\_mutex(proc) = TRUE$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Stop\_self \mapsto loc\_1$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop\_self \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Stop\_self \mapsto loc\_2$

act002: $locklevel\_of\_partition(part) := 0$

act003: $preempter\_of\_partition := \{part\} ⩤ preempter\_of\_partition$

end

Event stop_self_mutex_avail ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in (processes \cap ran(stop\_self\_proc))$

grd003: $core \in (CORES \cap dom(stop\_self\_proc)) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = stop\_self\_proc(core)$

grd013: $stop\_self\_proc(core) \in dom(processes\_of\_partition) \land processes\_of\_partition(stop\_self\_proc(core)) \in dom(current\_partition\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd014: $stop\_self\_proc(core) \in dom(preemption\_lock\_mutex)$

grd006: $part = current\_partition$

grd007: $current\_partition\_flag(part) = TRUE$

grd009: $preemption\_lock\_mutex(proc) = TRUE$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Stop\_self \mapsto loc\_2$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop\_self \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Stop\_self \mapsto loc\_3$

act002: $preemption\_lock\_mutex(proc) := FALSE$

end

Event stop_self_return_mutex ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap ran(stop\_self\_proc)$

grd003: $core \in (CORES \cap dom(stop\_self\_proc)) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = stop\_self\_proc(core)$

grd012: $stop\_self\_proc(core) \in dom(processes\_of\_partition) \land processes\_of\_partition(stop\_self\_proc(core)) \in dom(current\_partition\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd007: $current\_partition\_flag(part) = TRUE$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Stop\_self \mapsto loc\_3$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop\_self \mapsto loc\_3)$

then

act001: $location\_of\_service2(core) := Stop\_self \mapsto loc\_r$

act002: $finished\_core(core) := TRUE$

act003: $stop\_self\_proc := \{core\} ⩤ stop\_self\_proc$

end

Event stop_init ⟨ordinary⟩ $\widehat{=}$

refines stop

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \lor partition\_mode(part) = PM\_NORMAL$
grd017: $finished\_core2(core) = TRUE$
grd101: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START \Rightarrow ((process\_state(proc) = PS\_Waiting \lor process\_state(proc) = PS\_WaitandSuspend) \land newstate = PS\_Dormant)$
grd102: $partition\_mode(part) = PM\_NORMAL \Rightarrow ((process\_state(proc) = PS\_Ready \lor process\_state(proc) = PS\_Waiting \lor process\_state(proc) = PS\_WaitandSuspend \lor process\_state(proc) = PS\_Suspend \lor process\_state(proc) = PS\_Faulted) \land newstate = PS\_Dormant)$
grd201: $current\_partition = part$
grd205: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd202: $current\_partition\_flag(part) = TRUE$
grd203: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd204: $newstate = PS\_Dormant$

then

act001: $process\_state(proc) := newstate$
act201: $location\_of\_service2(core) := Stop \mapsto loc\_i$
act202: $finished\_core2(core) := FALSE$
act203: $stop\_proc(core) := proc$
act204: $timeout\_trigger := \{proc\} \lhd timeout\_trigger$

end

Event stop_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
reschedule

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$
grd003: $core \in CORES \cap dom(stop\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $part = current\_partition$
grd014: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd006: $current\_partition\_flag(part) = TRUE$
grd007: $proc = stop\_proc(core)$
grd008: $reschedule \in BOOL$
grd009: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd010: $reschedule = TRUE$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Stop \mapsto loc\_i$
grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Stop \mapsto loc\_1$
act002: $need\_reschedule := reschedule$

end

Event stop_return_no_mutex ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$
grd003: $core \in CORES \cap dom(stop\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = stop\_proc(core)$
grd006: $part = current\_partition$
grd013: $processes\_of\_partition(stop\_proc(core)) \in dom(current\_partition\_flag)$
grd012: $current\_partition\_flag(part) = TRUE$
grd007: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd014: $stop\_proc(core) \in dom(preemption\_lock\_mutex)$
grd008: $preemption\_lock\_mutex(proc) = FALSE$
grd009: $finished\_core2(core) = FALSE$
grd010: $location\_of\_service2(core) = Stop \mapsto loc\_1$
grd011: $\neg(finished\_core(core) = FALSE \land location\_of\_service2(core) = Stop \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Stop \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $stop\_proc := \{core\} ⩤ stop\_proc$

end

Event stop_mutex_zero ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$
grd003: $core \in CORES \cap dom(stop\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = stop\_proc(core)$
grd006: $part = current\_partition$
grd012: $processes\_of\_partition(stop\_proc(core)) \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd009: $finished\_core2(core) = FALSE$
grd010: $location\_of\_service2(core) = Stop \mapsto loc\_1$
grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Stop \mapsto loc\_2$
act002: $locklevel\_of\_partition(part) := 0$
act003: $preempter\_of\_partition := \{part\} ⩤ preempter\_of\_partition$

end

Event stop_mutex_avail ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(preemption\_lock\_mutex)$

grd003: $core \in CORES \cap dom(stop\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = stop\_proc(core)$
grd006: $part = current\_partition$
grd013: $processes\_of\_partition(stop\_proc(core)) \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd009: $preemption\_lock\_mutex(proc) = TRUE$
grd010: $finished\_core2(core) = FALSE$
grd011: $location\_of\_service2(core) = Stop \mapsto loc\_2$
grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Stop \mapsto loc\_3$
act002: $preemption\_lock\_mutex(proc) := FALSE$

end

Event stop_return_mutex ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$
grd003: $core \in CORES \cap dom(stop\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $part = current\_partition$
grd011: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd006: $current\_partition\_flag(part) = TRUE$
grd007: $current\_processes\_flag(core) = TRUE \Rightarrow proc \notin ran(current\_processes)$
grd008: $finished\_core2(core) = FALSE$
grd009: $location\_of\_service2(core) = Stop \mapsto loc\_3$
grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Stop \mapsto loc\_3)$

then

act001: $location\_of\_service2(core) := Stop \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $stop\_proc := \{core\} \lhd stop\_proc$

end

Event start_aperiodprocess_instart_init ⟨ordinary⟩ $\widehat{=}$

refines start

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process) \land proc \in dom(period\_of\_process)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd101: $current\_partition = part$
grd107: $part \in dom(current\_partition\_flag)$
grd102: $current\_partition\_flag(part) = TRUE$
grd103: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd104: $process\_state(proc) = PS\_Dormant$
grd105: $newstate = PS\_Waiting$
grd106: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

then

act001: $process\_state(proc) := newstate$
act101: $location\_of\_service2(core) := Start\_aperiod\_instart \mapsto loc\_i$

act102: $process\_wait\_type(proc) := PROC\_WAIT\_PARTITIONNORMAL$

act103: $finished\_core2(core) := FALSE$

act104: $start\_aperiod\_proc(core) := proc$

end

Event start_aperiodprocess_instart_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state)$

grd003: $core \in CORES \cap dom(start\_aperiod\_proc) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $proc = start\_aperiod\_proc(core)$

grd012: $part \in dom(current\_partition\_flag)$

grd006: $current\_partition = part$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $process\_state(proc) = PS\_Waiting$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Start\_aperiod\_instart \mapsto loc\_i$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_aperiod\_instart \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_instart \mapsto loc\_1$

act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event start_aperiodprocess_instart_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state)$

grd003: $core \in CORES \cap dom(start\_aperiod\_proc) \land core \in dom(location\_of\_service2)$

grd004: $proc = start\_aperiod\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd012: $part \in dom(current\_partition\_flag)$

grd006: $current\_partition = part$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $process\_state(proc) = PS\_Waiting$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Start\_aperiod\_instart \mapsto loc\_1$

grd011: $\neg(finished\_core2(core) = TRUE \land location\_of\_service2(core) = Start\_aperiod\_instart \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_instart \mapsto loc\_r$

act002: $finished\_core2(core) := TRUE$

act003: $start\_aperiod\_proc := \{core\} \lhd start\_aperiod\_proc$

end

Event start_aperiodprocess_innormal_init ⟨ordinary⟩ $\widehat{=}$

refines start

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process) \land proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd017: $finished\_core2(core) = TRUE$

grd101: $current\_partition = part$

grd108: $part \in dom(current\_partition\_flag)$

grd102: $current\_partition\_flag(part) = TRUE$

grd103: $current\_processes\_flag(core) = TRUE$

grd104: $partition\_mode(part) = PM\_NORMAL$

grd105: $process\_state(proc) = PS\_Dormant$

grd106: $newstate = PS\_Ready$

grd107: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

then

act001: $process\_state(proc) := newstate$

act101: $location\_of\_service2(core) := Start\_aperiod\_innormal \mapsto loc\_i$

act102: $finished\_core2(core) := FALSE$

act103: $start\_aperiod\_innormal\_proc(core) := proc$

end

Event start_aperiodprocess_innormal_deadline_time ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_aperiod\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = start\_aperiod\_innormal\_proc(core)$

grd014: $start\_aperiod\_innormal\_proc(core) \in dom(processes\_of\_partition)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $current\_partition = part$

grd015: $part \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = TRUE$

grd009: $process\_state(proc) = PS\_Ready$

grd010: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

grd011: $finished\_core2(core) = FALSE$

grd012: $location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_i$

grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_innormal \mapsto loc\_1$

act002: $deadlinetime\_of\_process(proc) := clock\_tick * ONE\_TICK\_TIME + timecapacity\_of\_process(proc)$

end

Event start_aperiodprocess_innormal_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

reschedule

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_aperiod\_innormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$
grd004: $reschedule \in BOOL$
grd005: $proc = start\_aperiod\_innormal\_proc(core)$
grd006: $processes\_of\_partition(proc) = part$
grd007: $current\_partition = part$
grd016: $part \in dom(current\_partition\_flag)$
grd008: $current\_partition\_flag(part) = TRUE$
grd009: $current\_processes\_flag(core) = TRUE$
grd010: $process\_state(proc) = PS\_Ready$
grd011: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd017: $processes\_of\_partition(start\_aperiod\_innormal\_proc(core)) \in dom(locklevel\_of\_partition)$

grd015: $(locklevel\_of\_partition(part) = 0 \Rightarrow reschedule = TRUE) \wedge (locklevel\_of\_partition(part) > 0 \Rightarrow reschedule = need\_reschedule)$
grd012: $finished\_core2(core) = FALSE$
grd013: $location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_1$
grd014: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_innormal \mapsto loc\_2$
act002: $need\_reschedule := reschedule$

end

Event start_aperiodprocess_innormal_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(start\_aperiod\_innormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$
grd004: $proc = start\_aperiod\_innormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $part = current\_partition$
grd014: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE$
grd009: $process\_state(proc) = PS\_Ready$
grd010: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_2$
grd013: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_innormal \mapsto loc\_3$
act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event start_aperiodprocess_innormal_return ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_aperiod\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $proc = start\_aperiod\_innormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $part = current\_partition$
grd014: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE$
grd009: $process\_state(proc) = PS\_Ready$
grd010: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_3$
grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_aperiod\_innormal \mapsto loc\_3)$

then

act001: $location\_of\_service2(core) := Start\_aperiod\_innormal \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $start\_aperiod\_innormal\_proc := \{core\} ⩤ start\_aperiod\_innormal\_proc$

end

Event start_periodprocess_instart_init ⟨ordinary⟩ $\widehat{=}$
refines start

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process) \land proc \in dom(period\_of\_process)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd101: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd107: $part \in dom(current\_partition\_flag)$
grd102: $current\_partition = part$
grd103: $current\_partition\_flag(part) = TRUE$
grd104: $process\_state(proc) = PS\_Dormant$
grd105: $newstate = PS\_Waiting$
grd106: $period\_of\_process(proc) > 0$

then

act001: $process\_state(proc) := newstate$
act101: $location\_of\_service2(core) := Start\_period\_instart \mapsto loc\_i$
act102: $finished\_core2(core) := FALSE$
act103: $process\_wait\_type(proc) := PROC\_WAIT\_PARTITIONNORMAL$
act104: $start\_period\_instart\_proc(core) := proc$

end

Event start_periodprocess_instart_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(start\_period\_instart\_proc) \land core \in dom(location\_of\_service2)$

grd004: $proc = start\_period\_instart\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $current\_partition = part$

grd013: $part \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $process\_state(proc) = PS\_Waiting$

grd009: $period\_of\_process(proc) > 0$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Start\_period\_instart \mapsto loc\_i$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_period\_instart \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Start\_period\_instart \mapsto loc\_1$

act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event start_periodprocess_instart_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_period\_instart\_proc) \land core \in dom(location\_of\_service2)$

grd004: $proc = start\_period\_instart\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $current\_partition = part$

grd013: $part \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $process\_state(proc) = PS\_Waiting$

grd009: $period\_of\_process(proc) > 0$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Start\_period\_instart \mapsto loc\_1$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_period\_instart \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Start\_period\_instart \mapsto loc\_r$

act002: $finished\_core2(core) := TRUE$

act003: $start\_period\_instart\_proc := \{core\} \lhd start\_period\_instart\_proc$

end

Event start_periodprocess_innormal_init ⟨ordinary⟩ $\widehat{=}$

refines start

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process) \land proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd017: $finished\_core2(core) = TRUE$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $current\_partition = part$

grd108: $part \in dom(current\_partition\_flag)$

grd109: $proc \in dom(releasepoint\_of\_process)$
grd103: $current\_partition\_flag(part) = TRUE$
grd104: $current\_processes\_flag(core) = TRUE$
grd105: $process\_state(proc) = PS\_Dormant$
grd106: $newstate = PS\_Waiting$
grd107: $period\_of\_process(proc) > 0$
grd110: $proc \notin ran(current\_processes)$

then

act001: $process\_state(proc) := newstate$
act101: $location\_of\_service2(core) := Start\_period\_innormal \mapsto loc\_i$
act102: $finished\_core2(core) := FALSE$
act103: $process\_wait\_type(proc) := PROC\_WAIT\_PERIOD$
act104: $start\_period\_innormal\_proc(core) := proc$

end

Event start_periodprocess_innormal_releasepoint ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
fstrl

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(start\_period\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd015: $fstrl \in \mathbb{N}_1$
grd004: $proc = start\_period\_innormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd007: $current\_partition = part$
grd017: $part \in dom(current\_partition\_flag)$
grd008: $current\_partition\_flag(part) = TRUE$
grd009: $current\_processes\_flag(core) = TRUE$
grd010: $process\_state(proc) = PS\_Waiting$
grd011: $period\_of\_process(proc) > 0$
grd016: $\exists x, y, b \cdot (((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow fstrl = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x)$
grd012: $finished\_core2(core) = FALSE$
grd013: $location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_i$
grd014: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Start\_period\_innormal \mapsto loc\_1$
act002: $releasepoint\_of\_process(proc) := fstrl$

end

Event start_periodprocess_innormal_deadlinetime ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
fstrl

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(start\_period\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $fstrl \in \mathbb{N}_1$

grd005: $proc = start\_period\_innormal\_proc(core)$

grd006: $processes\_of\_partition(proc) = part$

grd007: $partition\_mode(part) = PM\_NORMAL$

grd008: $current\_partition = part$

grd017: $part \in dom(current\_partition\_flag)$

grd009: $current\_partition\_flag(part) = TRUE$

grd010: $current\_processes\_flag(core) = TRUE$

grd011: $process\_state(proc) = PS\_Waiting$

grd012: $period\_of\_process(proc) > 0$

grd013: $\exists x, y, b \cdot (((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow fstrl = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x)$

grd014: $finished\_core2(core) = FALSE$

grd015: $location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_1$

grd016: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Start\_period\_innormal \mapsto loc\_2$

act002: $deadlinetime\_of\_process(proc) := fstrl + timecapacity\_of\_process(proc)$

end

Event start_periodprocess_innormal_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_period\_innormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$

grd004: $proc = start\_period\_innormal\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $partition\_mode(part) = PM\_NORMAL$

grd007: $current\_partition = part$

grd015: $part \in dom(current\_partition\_flag)$

grd008: $current\_partition\_flag(part) = TRUE$

grd009: $current\_processes\_flag(core) = TRUE$

grd010: $process\_state(proc) = PS\_Waiting$

grd011: $period\_of\_process(proc) > 0$

grd012: $finished\_core2(core) = FALSE$

grd013: $location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_2$

grd014: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Start\_period\_innormal \mapsto loc\_3$

act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event start_periodprocess_innormal_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(start\_period\_innormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$

grd004: $proc = start\_period\_innormal\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd007: $current\_partition = part$
grd015: $part \in dom(current\_partition\_flag)$
grd008: $current\_partition\_flag(part) = TRUE$
grd009: $current\_processes\_flag(core) = TRUE$
grd010: $process\_state(proc) = PS\_Waiting$
grd011: $period\_of\_process(proc) > 0$
grd012: $finished\_core2(core) = FALSE$
grd013: $location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_3$
grd014: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Start\_period\_innormal \mapsto loc\_3)$

then

act001: $location\_of\_service2(core) := Start\_period\_innormal \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $start\_period\_innormal\_proc := \{core\} \lhd start\_period\_innormal\_proc$

end

Event delay_start_aperiodprocess_instart_init ⟨ordinary⟩ $\widehat{=}$

refines delay_start

any

part
proc
newstate
core
delaytime

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd101: $current\_partition = part$
grd108: $part \in dom(current\_partition\_flag)$
grd102: $current\_partition\_flag(part) = TRUE$
grd103: $partition\_mode(part) = PM\_COLD\_START \vee partition\_mode(part) = PM\_WARM\_START$

grd104: $process\_state(proc) = PS\_Dormant$
grd105: $newstate = PS\_Waiting$
grd106: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd107: $delaytime \in \mathbb{N} \wedge delaytime \neq INFINITE\_TIME\_VALUE$

then

act001: $process\_state(proc) := newstate$
act101: $location\_of\_service2(core) := Delay\_start\_aperiod\_instart \mapsto loc\_i$
act102: $process\_wait\_type(proc) := PROC\_WAIT\_DELAY$
act103: $finished\_core2(core) := FALSE$
act104: $delay\_start\_ainstart\_proc(core) := proc$
act105: $delaytime\_of\_process(proc) := delaytime$

end

Event delay_start_aperiodprocess_instart_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_ainstart\_proc) \wedge core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = delay\_start\_ainstart\_proc(core)$
grd006: $current\_partition = part$
grd013: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $process\_state(proc) = PS\_Waiting$
grd009: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd010: $finished\_core2(core) = FALSE$
grd011: $location\_of\_service2(core) = Delay\_start\_aperiod\_instart \mapsto loc\_i$
grd012: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Delay\_start\_aperiod\_instart \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Delay\_start\_aperiod\_instart \mapsto loc\_1$
act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event delay_start_aperiodprocess_instart_return ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(delay\_start\_ainstart\_proc) \wedge core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = delay\_start\_ainstart\_proc(core)$
grd006: $current\_partition = part$
grd013: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $process\_state(proc) = PS\_Waiting$
grd009: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd010: $finished\_core2(core) = FALSE$
grd011: $location\_of\_service2(core) = Delay\_start\_aperiod\_instart \mapsto loc\_1$
grd012: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Delay\_start\_aperiod\_instart \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Delay\_start\_aperiod\_instart \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $delay\_start\_ainstart\_proc := \{core\} ⩤ delay\_start\_ainstart\_proc$

end

Event delay_start_aperiodprocess_innormal_init ⟨ordinary⟩ $\widehat{=}$

refines delay_start

any

part
proc
newstate
core
delaytime

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES \wedge core \in dom(current\_processes\_flag)$
grd005: $processes\_of\_partition(proc) = part$
grd102: $newstate = PS\_Waiting$
grd017: $finished\_core2(core) = TRUE$

grd201: $current\_partition = part$
grd209: $part \in dom(current\_partition\_flag)$
grd210: $proc \in dom(delaytime\_of\_process) \land proc \in dom(process\_wait\_type)$
grd202: $current\_partition\_flag(part) = TRUE$
grd203: $current\_processes\_flag(core) = TRUE$
grd204: $partition\_mode(part) = PM\_NORMAL$
grd205: $process\_state(proc) = PS\_Dormant$
grd206: $delaytime > 0 \land delaytime \neq INFINITE\_TIME\_VALUE$
grd207: $newstate = PS\_Waiting$
grd208: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd211: $proc \notin ran(current\_processes)$

then

act001: $process\_state(proc) := newstate$
act201: $location\_of\_service2(core) := Delay\_start\_aperiod\_innormal \mapsto loc\_i$
act202: $finished\_core2(core) := FALSE$
act203: $delay\_start\_ainnormal\_proc(core) := proc$
act204: $delay\_start\_ainnormal\_delaytime(core) := delaytime$
act205: $process\_wait\_type(proc) := PROC\_WAIT\_DELAY$

end

Event delay_start_aperiodprocess_innormal_deadline_time ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
delaytime

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(delay\_start\_ainnormal\_proc) \cap dom(delay\_start\_ainnormal\_delaytime) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd014: $delaytime \in \mathbb{N}$
grd004: $proc = delay\_start\_ainnormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $current\_partition = part$
grd016: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE$
grd009: $process\_state(proc) = PS\_Waiting$
grd010: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$
grd015: $delaytime = delay\_start\_ainnormal\_delaytime(core)$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_i$
grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Delay\_start\_aperiod\_innormal \mapsto loc\_1$
act002: $deadlinetime\_of\_process(proc) := clock\_tick * ONE\_TICK\_TIME + timecapacity\_of\_process(proc) + delaytime$

end

Event delay_start_aperiodprocess_innormal_trigger ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
delaytime

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_ainnormal\_delaytime) \cap dom(delay\_start\_ainnormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$

grd004: $delaytime \in \mathbb{N}$

grd005: $proc = delay\_start\_ainnormal\_proc(core)$

grd006: $delaytime = delay\_start\_ainnormal\_delaytime(core)$

grd007: $processes\_of\_partition(proc) = part$

grd008: $current\_partition = part$

grd016: $part \in dom(current\_partition\_flag)$

grd009: $current\_partition\_flag(part) = TRUE$

grd010: $current\_processes\_flag(core) = TRUE$

grd011: $process\_state(proc) = PS\_Waiting$

grd012: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

grd013: $finished\_core2(core) = FALSE$

grd014: $location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_1$

grd015: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Delay\_start\_aperiod\_innormal \mapsto loc\_2$

act002: $timeout\_trigger := timeout\_trigger \mathbin{\lhd\!\!-} \{proc \mapsto (PS\_Ready \mapsto (delaytime + clock\_tick * ONE\_TICK\_TIME))\}$

end

Event delay_start_aperiodprocess_innormal_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
reschedule

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \wedge proc \in dom(processes\_of\_partition) \wedge proc \in dom(process\_state) \wedge proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_ainnormal\_proc) \wedge core \in dom(current\_processes\_flag) \wedge core \in dom(location\_of\_service2)$

grd014: $reschedule \in BOOL$

grd004: $proc = delay\_start\_ainnormal\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $current\_partition = part$

grd016: $part \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = TRUE$

grd009: $process\_state(proc) = PS\_Waiting$

grd010: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

grd017: $processes\_of\_partition(delay\_start\_ainnormal\_proc(core)) \in dom(locklevel\_of\_partition)$

grd015: $(locklevel\_of\_partition(part) = 0 \Rightarrow reschedule = TRUE) \wedge (locklevel\_of\_partition(part) > 0 \Rightarrow reschedule = need\_reschedule)$

grd011: $finished\_core2(core) = FALSE$

grd012: $location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_2$

grd013: $\neg(finished\_core2(core) = FALSE \wedge location\_of\_service2(core) = Delay\_start\_aperiod\_innormal \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Delay\_start\_aperiod\_innormal \mapsto loc\_3$

act002: $need\_reschedule := reschedule$

end

Event delay_start_aperiodprocess_innormal_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $\mathit{part} \in \mathit{PARTITIONS}$

grd002: $\mathit{proc} \in \mathit{processes} \land \mathit{proc} \in \mathrm{dom}(\mathit{processes\_of\_partition}) \land \mathit{proc} \in \mathrm{dom}(\mathit{process\_state}) \land \mathit{proc} \in \mathrm{dom}(\mathit{period\_of\_process})$

grd003: $\mathit{core} \in \mathit{CORES} \cap \mathrm{dom}(\mathit{delay\_start\_ainnormal\_proc}) \land \mathit{core} \in \mathrm{dom}(\mathit{current\_processes\_flag}) \land \mathit{core} \in \mathrm{dom}(\mathit{location\_of\_service2})$

grd004: $\mathit{proc} = \mathit{delay\_start\_ainnormal\_proc}(\mathit{core})$

grd005: $\mathit{processes\_of\_partition}(\mathit{proc}) = \mathit{part}$

grd006: $\mathit{current\_partition} = \mathit{part}$

grd014: $\mathit{part} \in \mathrm{dom}(\mathit{current\_partition\_flag})$

grd007: $\mathit{current\_partition\_flag}(\mathit{part}) = \mathit{TRUE}$

grd008: $\mathit{current\_processes\_flag}(\mathit{core}) = \mathit{TRUE}$

grd009: $\mathit{process\_state}(\mathit{proc}) = \mathit{PS\_Waiting}$

grd010: $\mathit{period\_of\_process}(\mathit{proc}) = \mathit{INFINITE\_TIME\_VALUE}$

grd011: $\mathit{finished\_core2}(\mathit{core}) = \mathit{FALSE}$

grd012: $\mathit{location\_of\_service2}(\mathit{core}) = \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_3}$

grd013: $\neg(\mathit{finished\_core2}(\mathit{core}) = \mathit{FALSE} \land \mathit{location\_of\_service2}(\mathit{core}) = \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_3})$

then

act001: $\mathit{location\_of\_service2}(\mathit{core}) := \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_4}$

act002: $\mathit{currentpriority\_of\_process}(\mathit{proc}) := \mathit{basepriority\_of\_process}(\mathit{proc})$

end

Event delay_start_aperiodprocess_innormal_return ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $\mathit{part} \in \mathit{PARTITIONS}$

grd002: $\mathit{proc} \in \mathit{processes} \land \mathit{proc} \in \mathrm{dom}(\mathit{processes\_of\_partition}) \land \mathit{proc} \in \mathrm{dom}(\mathit{process\_state}) \land \mathit{proc} \in \mathrm{dom}(\mathit{period\_of\_process})$

grd003: $\mathit{core} \in \mathit{CORES} \cap \mathrm{dom}(\mathit{delay\_start\_ainnormal\_proc}) \cap \mathrm{dom}(\mathit{delay\_start\_ainnormal\_delaytime}) \land \mathit{core} \in \mathrm{dom}(\mathit{current\_processes\_flag}) \land \mathit{core} \in \mathrm{dom}(\mathit{location\_of\_service2})$

grd004: $\mathit{proc} = \mathit{delay\_start\_ainnormal\_proc}(\mathit{core})$

grd005: $\mathit{processes\_of\_partition}(\mathit{proc}) = \mathit{part}$

grd006: $\mathit{current\_partition} = \mathit{part}$

grd014: $\mathit{part} \in \mathrm{dom}(\mathit{current\_partition\_flag})$

grd007: $\mathit{current\_partition\_flag}(\mathit{part}) = \mathit{TRUE}$

grd008: $\mathit{current\_processes\_flag}(\mathit{core}) = \mathit{TRUE}$

grd009: $\mathit{process\_state}(\mathit{proc}) = \mathit{PS\_Waiting}$

grd010: $\mathit{period\_of\_process}(\mathit{proc}) = \mathit{INFINITE\_TIME\_VALUE}$

grd011: $\mathit{finished\_core2}(\mathit{core}) = \mathit{FALSE}$

grd012: $\mathit{location\_of\_service2}(\mathit{core}) = \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_4}$

grd013: $\neg(\mathit{finished\_core2}(\mathit{core}) = \mathit{FALSE} \land \mathit{location\_of\_service2}(\mathit{core}) = \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_4})$

then

act001: $\mathit{location\_of\_service2}(\mathit{core}) := \mathit{Delay\_start\_aperiod\_innormal} \mapsto \mathit{loc\_r}$

act002: $\mathit{finished\_core2}(\mathit{core}) := \mathit{TRUE}$

act003: $\mathit{delay\_start\_ainnormal\_proc} := \{\mathit{core}\} \mathbin{\lhd\!\!\!-} \mathit{delay\_start\_ainnormal\_proc}$

act004: $\mathit{delay\_start\_ainnormal\_delaytime} := \{\mathit{core}\} \mathbin{\lhd\!\!\!-} \mathit{delay\_start\_ainnormal\_delaytime}$

end

Event delay_start_periodprocess_instart_init ⟨ordinary⟩ $\widehat{=}$

refines delay_start

any

part
proc
newstate
core
delaytime

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $processes\_of\_partition(proc) = part$

grd017: $finished\_core2(core) = TRUE$

grd201: $current\_partition = part$

grd208: $part \in dom(current\_partition\_flag)$

grd202: $current\_partition\_flag(part) = TRUE$

grd203: $partition\_mode(part) = PM\_COLD\_START \lor partition\_mode(part) = PM\_WARM\_START$

grd204: $process\_state(proc) = PS\_Dormant$

grd205: $newstate = PS\_Waiting$

grd206: $period\_of\_process(proc) > 0$

grd207: $delaytime \in \mathbb{N} \land delaytime \neq INFINITE\_TIME\_VALUE \land delaytime < period\_of\_process(proc)$

then

act001: $process\_state(proc) := newstate$

act201: $location\_of\_service2(core) := Delay\_start\_period\_instart \mapsto loc\_i$

act202: $process\_wait\_type(proc) := PROC\_WAIT\_DELAY$

act203: $finished\_core2(core) := FALSE$

act204: $delaytime\_of\_process(proc) := delaytime$

act205: $delay\_start\_instart\_proc(core) := proc$

end

Event delay_start_periodprocess_instart_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_instart\_proc) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $proc = delay\_start\_instart\_proc(core)$

grd006: $current\_partition = part$

grd013: $part \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $process\_state(proc) = PS\_Waiting$

grd009: $period\_of\_process(proc) > 0$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Delay\_start\_period\_instart \mapsto loc\_i$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_instart \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_instart \mapsto loc\_1$

act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event delay_start_periodprocess_instart_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_instart\_proc) \land core \in dom(location\_of\_service2)$
grd004: $processes\_of\_partition(proc) = part$
grd005: $proc = delay\_start\_instart\_proc(core)$
grd006: $current\_partition = part$
grd013: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $process\_state(proc) = PS\_Waiting$
grd009: $period\_of\_process(proc) > 0$
grd010: $finished\_core2(core) = FALSE$
grd011: $location\_of\_service2(core) = Delay\_start\_period\_instart \mapsto loc\_1$
grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_instart \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_instart \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $delay\_start\_instart\_proc := \{core\} \mathbin{\lhd\mkern-14mu-} delay\_start\_instart\_proc$

end

Event delay_start_periodprocess_innormal_init ⟨ordinary⟩ $\widehat{=}$
refines delay_start

any

part
proc
newstate
core
delaytime

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd102: $newstate = PS\_Waiting$
grd201: $partition\_mode(part) = PM\_NORMAL$
grd202: $current\_partition = part$
grd208: $part \in dom(current\_partition\_flag)$
grd209: $proc \in dom(releasepoint\_of\_process)$
grd203: $current\_partition\_flag(part) = TRUE$
grd204: $current\_processes\_flag(core) = TRUE$
grd205: $process\_state(proc) = PS\_Dormant$
grd206: $period\_of\_process(proc) > 0$
grd207: $delaytime \in \mathbb{N} \land delaytime > 0 \land delaytime < period\_of\_process(proc)$
grd210: $proc \notin ran(current\_processes)$

then

act001: $process\_state(proc) := newstate$
act201: $location\_of\_service2(core) := Delay\_start\_period\_innormal \mapsto loc\_i$
act202: $finished\_core2(core) := FALSE$
act203: $process\_wait\_type(proc) := PROC\_WAIT\_DELAY$
act204: $delaytime\_of\_process(proc) := delaytime$
act205: $delay\_start\_innormal\_proc(core) := proc$
act206: $delay\_start\_innormal\_delaytime(core) := delaytime$

end

Event delay_start_periodprocess_innormal_releasepoint ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
fstrl

delaytime

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_innormal\_proc) \cap dom(delay\_start\_ainnormal\_delaytime) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd006: $fstrl \in \mathbb{N}_1$

grd017: $delaytime = delay\_start\_ainnormal\_delaytime(core)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $proc = delay\_start\_innormal\_proc(core)$

grd007: $partition\_mode(part) = PM\_NORMAL$

grd008: $current\_partition = part$

grd018: $part \in dom(current\_partition\_flag)$

grd009: $current\_partition\_flag(part) = TRUE$

grd010: $current\_processes\_flag(core) = TRUE$

grd011: $process\_state(proc) = PS\_Waiting$

grd012: $period\_of\_process(proc) > 0$

grd013: $\exists x, y, b \cdot (((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow fstrl = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x)$

grd014: $finished\_core2(core) = FALSE$

grd015: $location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_i$

grd016: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_innormal \mapsto loc\_1$

act002: $releasepoint\_of\_process(proc) := fstrl + delaytime$

end

Event delay_start_periodprocess_innormal_deadlinetime ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

fstrl

delaytime

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$

grd003: $core \in CORES \cap dom(delay\_start\_innormal\_delaytime) \cap dom(delay\_start\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $delaytime = delay\_start\_innormal\_delaytime(core)$

grd005: $proc = delay\_start\_innormal\_proc(core)$

grd006: $\exists x, y, b \cdot (((x \mapsto y) \mapsto b) = firstperiodicprocstart\_timeWindow\_of\_Partition(part) \Rightarrow fstrl = ((clock\_tick * ONE\_TICK\_TIME)/majorFrame + 1) * majorFrame + x)$

grd007: $processes\_of\_partition(proc) = part$

grd008: $partition\_mode(part) = PM\_NORMAL$

grd009: $current\_partition = part$

grd017: $part \in dom(current\_partition\_flag)$

grd010: $current\_partition\_flag(part) = TRUE$

grd011: $current\_processes\_flag(core) = TRUE$

grd012: $process\_state(proc) = PS\_Waiting$

grd013: $period\_of\_process(proc) > 0$

grd014: $finished\_core2(core) = FALSE$

grd015: $location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_1$

grd016: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_innormal \mapsto loc\_2$

act002: $deadlinetime\_of\_process(proc) := fstrl + delaytime + timecapacity\_of\_process(proc)$

end

Event delay_start_periodprocess_innormal_currentpri ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(delay\_start\_innormal\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $proc = delay\_start\_innormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $part = current\_partition$
grd014: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE$
grd009: $process\_state(proc) = PS\_Waiting$
grd010: $period\_of\_process(proc) > 0$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_2$
grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_innormal \mapsto loc\_3$
act002: $currentpriority\_of\_process(proc) := basepriority\_of\_process(proc)$

end

Event delay_start_periodprocess_innormal_return ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_state) \land proc \in dom(period\_of\_process)$
grd003: $core \in CORES \cap dom(delay\_start\_innormal\_proc) \cap dom(delay\_start\_innormal\_delaytime) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$
grd004: $proc = delay\_start\_innormal\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $current\_partition = part$
grd014: $part \in dom(current\_partition\_flag)$
grd007: $current\_partition\_flag(part) = TRUE$
grd008: $current\_processes\_flag(core) = TRUE$
grd009: $process\_state(proc) = PS\_Waiting$
grd010: $period\_of\_process(proc) > 0$
grd011: $finished\_core2(core) = FALSE$
grd012: $location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_3$
grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Delay\_start\_period\_innormal \mapsto loc\_3)$

then

act001: $location\_of\_service2(core) := Delay\_start\_period\_innormal \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $delay\_start\_innormal\_proc := \{core\} ⩤ delay\_start\_innormal\_proc$
act004: $delay\_start\_innormal\_delaytime := \{core\} ⩤ delay\_start\_innormal\_delaytime$

end

Event get_my_id ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS \cap dom(current\_partition\_flag)$
grd002: $core \in CORES \cap dom(current\_processes\_flag)$
grd007: $proc \in processes$
grd003: $current\_partition\_flag(part) = TRUE$
grd004: $current\_processes\_flag(core) = TRUE$
grd008: $proc = current\_processes(core)$
grd005: $current\_partition = part$
grd006: $part \in dom(errorhandler\_of\_partition) \Rightarrow proc \neq errorhandler\_of\_partition(part)$
grd009: $finished\_core(core) = TRUE$

then

skip

end

Event initialize_process_core_affinity ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes$
grd003: $core \in CORES$
grd004: $partition\_mode(part) = PM\_COLD\_START \vee partition\_mode(part) = PM\_WARM\_START$

grd005: $finished\_core(core) = TRUE$

then

skip

end

Event get_my_processor_core_id ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes$
grd003: $core \in CORES \wedge core \in dom(current\_processes\_flag)$
grd004: $partition\_mode(part) = PM\_NORMAL$
grd005: $part = current\_partition \wedge current\_partition \in dom(current\_partition\_flag)$
grd006: $current\_partition\_flag(part) = TRUE$
grd007: $current\_processes\_flag(core) = TRUE$
grd008: $proc = current\_processes(core)$
grd009: $finished\_core(core) = TRUE$

then

skip

end

Event process_faulted ⟨ordinary⟩ $\widehat{=}$

new!! running –> faulted

extends process_faulted

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $processes\_of\_partition(proc) = part$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running \land newstate = PS\_Faulted$

grd305: $part \in dom(current\_partition\_flag)$

grd301: $part = current\_partition$

grd304: $core \in dom(current\_processes)$

grd307: $current\_processes\_flag(core) = TRUE$

grd302: $proc = current\_processes(core)$

grd303: $current\_partition\_flag(part) = TRUE$

grd306: $current\_processes\_flag(core) = TRUE$

then

act001: $process\_state(proc) := newstate$

act301: $need\_reschedule := TRUE$

act302: $current\_processes\_flag(core) := FALSE$

act303: $current\_processes := \{core\} \mathbin{⩤} current\_processes$

end

Event time_wait_init ⟨ordinary⟩ $\widehat{=}$

refines time_wait

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS \land part \in dom(locklevel\_of\_partition) \land part \in dom(current\_partition\_flag)$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes)$

grd005: $processes\_of\_partition(proc) = part$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running \land (newstate = PS\_Ready \lor newstate = PS\_Waiting)$

grd209: $proc \in dom(delaytime\_of\_process) \land proc \in dom(process\_wait\_type)$

grd207: $current\_partition\_flag(part) = TRUE$

grd206: $current\_processes\_flag(core) = TRUE$

grd201: $proc = current\_processes(core)$

grd202: $part = current\_partition$

grd203: $part \in dom(errorhandler\_of\_partition) \Rightarrow proc \neq errorhandler\_of\_partition(part)$

grd208: $periodtype\_of\_process(proc) = APERIOD\_PROC \lor periodtype\_of\_process(proc) = PERIOD\_PROC$

grd204: $locklevel\_of\_partition(part) = 0$

grd205: $finished\_core2(core) = TRUE$

then

act001: $process\_state(proc) := newstate$

act201: $location\_of\_service2(core) := Time\_Wait \mapsto loc\_i$

act202: $finished\_core2(core) := FALSE$

act203: $time\_wait\_proc(core) := proc$

act204: $current\_processes\_flag(core) := FALSE$

act205: $current\_processes := \{core\} \mathbin{⩤} current\_processes$

end

Event time_wait_delay_time ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

delaytime

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $core \in CORES \cap dom(time\_wait\_proc) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $proc = time\_wait\_proc(core)$

grd012: $part \in dom(locklevel\_of\_partition)$

grd007: $locklevel\_of\_partition(part) = 0$

grd008: $delaytime \in \mathbb{N}_1$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Time\_Wait \mapsto loc\_i$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Time\_Wait \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Time\_Wait \mapsto loc\_1$

act002: $timeout\_trigger := timeout\_trigger \mathbin{<\!\!+} \{proc \mapsto (PS\_Ready \mapsto (delaytime + clock\_tick * ONE\_TICK\_TIME))\}$

act003: $process\_wait\_type(proc) := PROC\_WAIT\_TIMEOUT$

act004: $delaytime\_of\_process(proc) := delaytime$

end

Event time_wait_reschedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $core \in CORES \cap dom(time\_wait\_proc) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $proc = time\_wait\_proc(core)$

grd011: $part \in dom(locklevel\_of\_partition)$

grd007: $locklevel\_of\_partition(part) = 0$

grd008: $finished\_core2(core) = FALSE$

grd009: $location\_of\_service2(core) = Time\_Wait \mapsto loc\_1$

grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Time\_Wait \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Time\_Wait \mapsto loc\_2$

act002: $need\_reschedule := TRUE$

end

Event time_wait_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $core \in CORES \cap dom(time\_wait\_proc) \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $proc = time\_wait\_proc(core)$

grd011: $part \in dom(locklevel\_of\_partition)$

grd007: $locklevel\_of\_partition(part) = 0$

grd008: $finished\_core2(core) = FALSE$

grd009: $location\_of\_service2(core) = Time\_Wait \mapsto loc\_2$

grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Time\_Wait \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Time\_Wait \mapsto loc\_r$

act002: $time\_wait\_proc := \{core\} \lhd\!\!\!- \, time\_wait\_proc$

act003: $finished\_core2(core) := TRUE$

end

Event period_wait_init ⟨ordinary⟩ $\widehat{=}$

refines period_wait

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(period\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $processes\_of\_partition(proc) = part$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running \land newstate = PS\_Waiting$

grd210: $proc \in dom(delaytime\_of\_process) \land proc \in dom(process\_wait\_type)$

grd201: $current\_processes\_flag(core) = TRUE$

grd209: $part \in dom(current\_partition\_flag) \land part \in dom(locklevel\_of\_partition)$

grd202: $current\_partition\_flag(part) = TRUE$

grd203: $part = current\_partition$

grd204: $proc = current\_processes(core)$

grd205: $part \in dom(errorhandler\_of\_partition) \Rightarrow proc \neq errorhandler\_of\_partition(part)$

grd206: $locklevel\_of\_partition(part) = 0$

grd207: $period\_of\_process(proc) > 0$

grd208: $finished\_core2(core) = TRUE$

then

act001: $process\_state(proc) := newstate$

act201: $location\_of\_service2(core) := Period\_Wait \mapsto loc\_i$

act202: $finished\_core2(core) := FALSE$

act203: $period\_wait\_proc(core) := proc$

act204: $current\_processes\_flag(core) := FALSE$

act205: $current\_processes := \{core\} \lhd\!\!\!- \, current\_processes$

end

Event period_wait_deadline_time ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS \land part \in dom(current\_partition\_flag) \land part \in dom(locklevel\_of\_partition)$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd014: $proc \in dom(period\_of\_process)$

grd003: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(period\_wait\_proc)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $current\_processes\_flag(core) = TRUE$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $proc = period\_wait\_proc(core)$

grd009: $locklevel\_of\_partition(part) = 0$

grd010: $period\_of\_process(proc) > 0$

grd011: $finished\_core2(core) = FALSE$

grd012: $location\_of\_service2(core) = Period\_Wait \mapsto loc\_i$

grd013: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Period\_Wait \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Period\_Wait \mapsto loc\_1$

act002: $releasepoint\_of\_process(proc) := releasepoint\_of\_process(proc) + period\_of\_process(proc)$

act003: $deadlinetime\_of\_process(proc) := releasepoint\_of\_process(proc) + timecapacity\_of\_process(proc)$

act004: $process\_wait\_type(proc) := PROC\_WAIT\_PERIOD$

end

Event period_wait_schedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS \land part \in dom(current\_partition\_flag) \land part \in dom(locklevel\_of\_partition)$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(period\_wait\_proc)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $current\_processes\_flag(core) = TRUE$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $proc = period\_wait\_proc(core)$

grd009: $locklevel\_of\_partition(part) = 0$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Period\_Wait \mapsto loc\_1$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Period\_Wait \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Period\_Wait \mapsto loc\_2$

act002: $need\_reschedule := TRUE$

end

Event period_wait_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS \land part \in dom(current\_partition\_flag)$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $core \in CORES \land core \in dom(location\_of\_service2)$

grd004: $processes\_of\_partition(proc) = part$

grd005: $partition\_mode(part) = PM\_NORMAL$

grd006: $current\_processes\_flag(core) = TRUE$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $finished\_core2(core) = FALSE$

grd009: $location\_of\_service2(core) = Period\_Wait \mapsto loc\_2$

grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Period\_Wait \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Period\_Wait \mapsto loc\_r$

act002: $period\_wait\_proc := \{core\} \lhd period\_wait\_proc$

act003: $finished\_core2(core) := TRUE$

end

Event get_time ⟨ordinary⟩ $\widehat{=}$

any

part

core

where

grd001: $part \in PARTITIONS \land part \in dom(current\_partition\_flag)$

grd002: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd003: $part = current\_partition$
grd004: $current\_processes\_flag(core) = TRUE \land current\_partition\_flag(part) = TRUE$
grd005: $partition\_mode(part) = PM\_NORMAL$

then

skip

end

Event replenish ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core
budget_time
ddtm

where

grd001: $part \in PARTITIONS \land part \in dom(current\_partition\_flag)$
grd002: $core \in CORES \land core \in dom(current\_processes) \land core \in dom(current\_processes\_flag)$
grd012: $proc \in processes \land proc \in dom(period\_of\_process) \land proc \in dom(releasepoint\_of\_process) \land$
$proc \in dom(timecapacity\_of\_process)$
grd003: $part = current\_partition$
grd013: $current\_processes\_flag(core) = TRUE$
grd004: $proc = current\_processes(core)$
grd005: $current\_partition\_flag(part) = TRUE$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd007: $budget\_time \in \mathbb{N}$
grd008: $ddtm \in \mathbb{N}$
grd009:
$period\_of\_process(proc) > 0$
$\land clock\_tick * ONE\_TICK\_TIME + budget\_time \leq releasepoint\_of\_process(proc) + timecapacity\_of\_process(proc)$

grd010: $budget\_time > 0 \Rightarrow ddtm = clock\_tick * ONE\_TICK\_TIME + budget\_time$
grd011: $(budget\_time = INFINITE\_TIME\_VALUE \lor timecapacity\_of\_process(proc) = INFINITE\_TIME\_VA$
$ddtm = INFINITE\_TIME\_VALUE$

then

act001: $deadlinetime\_of\_process(proc) := ddtm$

end

Event aperiodicprocess_finished ⟨ordinary⟩ $\widehat{=}$

extends process_finished

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd101: $partition\_mode(part) = PM\_NORMAL$
grd102: $process\_state(proc) = PS\_Running \land (newstate = PS\_Waiting \lor newstate = PS\_Dormant)$

grd201: $proc \in dom(process\_wait\_type) \land proc \in dom(period\_of\_process)$
grd307: $core \in dom(current\_processes\_flag)$
grd308: $part \in dom(current\_partition\_flag)$
grd301: $part = current\_partition$
grd306: $current\_processes\_flag(core) = TRUE$
grd302: $proc = current\_processes(core)$
grd303: $current\_partition\_flag(part) = TRUE$
grd304: $newstate = PS\_Dormant$

grd305: $period\_of\_process(proc) = INFINITE\_TIME\_VALUE$

then

act001: $process\_state(proc) := newstate$

act301: $need\_reschedule := TRUE$

act302: $current\_processes\_flag(core) := FALSE$

act303: $current\_processes := \{core\} ⩤ current\_processes$

end

Event periodicprocess_finished ⟨ordinary⟩ $\widehat{=}$

extends process_finished

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $processes\_of\_partition(proc) = part$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running \wedge (newstate = PS\_Waiting \vee newstate = PS\_Dormant)$

grd201: $proc \in dom(process\_wait\_type) \wedge proc \in dom(period\_of\_process)$

grd307: $core \in dom(current\_processes\_flag)$

grd308: $part \in dom(current\_partition\_flag)$

grd301: $part = current\_partition$

grd306: $current\_processes\_flag(core) = TRUE$

grd302: $proc = current\_processes(core)$

grd303: $current\_partition\_flag(part) = TRUE$

grd304: $newstate = PS\_Waiting$

grd305: $period\_of\_process(proc) \neq INFINITE\_TIME\_VALUE$

then

act001: $process\_state(proc) := newstate$

act301: $need\_reschedule := TRUE$

act302: $process\_wait\_type(proc) := PROC\_WAIT\_PERIOD$

act303: $current\_processes\_flag(core) := FALSE$

act304: $current\_processes := \{core\} ⩤ current\_processes$

end

Event time_out ⟨ordinary⟩ $\widehat{=}$

extends time_out

any

part

proc

newstate

core

time

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $processes\_of\_partition(proc) = part$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Waiting \vee process\_state(proc) = PS\_Suspend \vee process\_state(proc) = PS\_WaitandSuspend$

grd103: $process\_state(proc) = PS\_Waiting \vee process\_state(proc) = PS\_Suspend \Rightarrow newstate = PS\_Ready$

grd104: $process\_state(proc) = PS\_WaitandSuspend \Rightarrow newstate = PS\_Suspend$

grd201: $time \in \mathbb{N}$

grd202: $proc \in dom(timeout\_trigger)$

grd203: $newstate \mapsto time = timeout\_trigger(proc)$

grd204: $time \geq (clock\_tick - 1) * ONE\_TICK\_TIME \land time \leq clock\_tick * ONE\_TICK\_TIME$

grd205: $process\_state(proc) = PS\_Waiting$

then

act001: $process\_state(proc) := newstate$

act201: $timeout\_trigger := timeout\_trigger \setminus \{proc \mapsto (newstate \mapsto time)\}$

act202: $process\_wait\_type := \{proc\} \lhd process\_wait\_type$

end

Event req_busy_resource_init ⟨ordinary⟩ $\widehat{=}$

refines req_busy_resource

any

part

proc

newstate

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(process\_wait\_type)$

grd003: $newstate \in PROCESS\_STATES$

grd004: $core \in CORES \land core \in dom(current\_processes\_flag)$

grd005: $processes\_of\_partition(proc) = part$

grd017: $finished\_core2(core) = TRUE$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $process\_state(proc) = PS\_Running$

grd103: $newstate = PS\_Waiting$

grd205: $proc \in dom(delaytime\_of\_process) \land proc \in dom(process\_wait\_type)$

grd201: $part = current\_partition \land current\_partition \in dom(current\_partition\_flag)$

grd202: $current\_partition\_flag(part) = TRUE$

grd203: $current\_processes\_flag(core) = TRUE$

grd204: $proc = current\_processes(core)$

then

act001: $process\_state(proc) := newstate$

act002: $location\_of\_service2(core) := Req\_busy\_resource \mapsto loc\_i$

act003: $finished\_core2(core) := FALSE$

act004: $req\_busy\_resource\_proc(core) := proc$

act005: $current\_processes\_flag(core) := FALSE$

act006: $current\_processes := \{core\} \lhd current\_processes$

end

Event req_busy_resource_timeout ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

timeout

tmout_trig

wt

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \cap dom(req\_busy\_resource\_proc) \land core \in dom(current\_processes\_flag) \land$
$core \in dom(location\_of\_service2)$

grd004: $proc = req\_busy\_resource\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd018: $processes\_of\_partition(req\_busy\_resource\_proc(core)) \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = TRUE$

grd009: $timeout \geq 0$

grd010: $wt \in PROCESS\_WAIT\_TYPES \land (wt = PROC\_WAIT\_OBJ \lor wt = PROC\_WAIT\_TIMEOUT)$

grd011: $tmout\_trig \in processes \mathrel{+\!\!\!\!\rightarrow} (PROCESS\_STATES \times \mathbb{N}_1)$

grd012:
$(timeout = INFINITE\_TIME\_VALUE \Rightarrow tmout\_trig = \varnothing)$
$\land (timeout > 0 \Rightarrow tmout\_trig = \{proc \mapsto (PS\_Ready \mapsto (timeout + clock\_tick * ONE\_TICK\_TIME))\})$

grd013: $timeout > 0 \Rightarrow wt = PROC\_WAIT\_TIMEOUT$

grd014: $timeout = INFINITE\_TIME\_VALUE \Rightarrow wt = PROC\_WAIT\_OBJ$

grd015: $finished\_core2(core) = FALSE$

grd016: $location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_i$

grd017: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Req\_busy\_resource \mapsto loc\_1$

act002: $timeout\_trigger := timeout\_trigger \mathbin{<\!\!\!+} tmout\_trig$

act003: $process\_wait\_type(proc) := wt$

end

Event req_busy_resource_schedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \cap dom(req\_busy\_resource\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = req\_busy\_resource\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd012: $processes\_of\_partition(req\_busy\_resource\_proc(core)) \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = FALSE$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_1$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Req\_busy\_resource \mapsto loc\_2$

act002: $need\_reschedule := TRUE$

end

Event req_busy_resource_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \cap dom(req\_busy\_resource\_proc) \land core \in dom(current\_processes\_flag) \land core \in dom(location\_of\_service2)$

grd004: $proc = req\_busy\_resource\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $part = current\_partition$

grd012: $processes\_of\_partition(req\_busy\_resource\_proc(core)) \in dom(current\_partition\_flag)$

grd007: $current\_partition\_flag(part) = TRUE$

grd008: $current\_processes\_flag(core) = FALSE$
grd009: $finished\_core2(core) = FALSE$
grd010: $location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_2$
grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Req\_busy\_resource \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Req\_busy\_resource \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $req\_busy\_resource\_proc := \{core\} ⩤ req\_busy\_resource\_proc$

end

Event resource_become_available_init ⟨ordinary⟩ $\widehat{=}$
refines resource_become_available

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state)$
grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd017: $finished\_core2(core) = TRUE$
grd101: $partition\_mode(part) = PM\_NORMAL$
grd102: $process\_state(proc) = PS\_Waiting \lor process\_state(proc) = PS\_WaitandSuspend$
grd103: $process\_state(proc) = PS\_Waiting \Rightarrow newstate = PS\_Ready$
grd104: $process\_state(proc) = PS\_WaitandSuspend \Rightarrow newstate = PS\_Suspend$
grd201: $part = current\_partition$
grd203: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd202: $current\_partition\_flag(part) = TRUE$

then

act001: $process\_state(proc) := newstate$
act201: $location\_of\_service2(core) := Resource\_become\_avail \mapsto loc\_i$
act202: $finished\_core2(core) := FALSE$
act203: $resource\_become\_avail\_proc(core) := proc$
act204: $timeout\_trigger := \{proc\} ⩤ timeout\_trigger$

end

Event resource_become_available_timeout_trig ⟨ordinary⟩ $\widehat{=}$

any

part
proc
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \land proc \in dom(processes\_of\_partition) \land proc \in dom(process\_wait\_type)$
grd003: $core \in CORES \cap dom(resource\_become\_avail\_proc) \land core \in dom(location\_of\_service2)$
grd004: $proc = resource\_become\_avail\_proc(core)$
grd005: $processes\_of\_partition(proc) = part$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd007: $part = current\_partition$
grd013: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$
grd008: $current\_partition\_flag(part) = TRUE$
grd009: $process\_wait\_type(proc) = PROC\_WAIT\_OBJ$
grd010: $finished\_core2(core) = FALSE$
grd011: $location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_i$
grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail \mapsto loc\_1$

act002: $process\_wait\_type := \{proc\} \mathbin{⩤} process\_wait\_type$

end

Event resource_become_available_schedule ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

resch

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \cap dom(resource\_become\_avail\_proc) \land core \in dom(location\_of\_service2)$

grd004: $proc = resource\_become\_avail\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $partition\_mode(part) = PM\_NORMAL$

grd007: $part = current\_partition$

grd013: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$

grd008: $current\_partition\_flag(part) = TRUE$

grd009: $resch \in BOOL$

grd010: $finished\_core2(core) = FALSE$

grd011: $location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_1$

grd012: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail \mapsto loc\_2$

act002: $need\_reschedule := resch$

end

Event resource_become_available_return ⟨ordinary⟩ $\widehat{=}$

any

part

proc

core

where

grd001: $part \in PARTITIONS$

grd002: $proc \in processes \land proc \in dom(processes\_of\_partition)$

grd003: $core \in CORES \cap dom(resource\_become\_avail\_proc) \land core \in dom(location\_of\_service2)$

grd004: $proc = resource\_become\_avail\_proc(core)$

grd005: $processes\_of\_partition(proc) = part$

grd006: $partition\_mode(part) = PM\_NORMAL$

grd007: $part = current\_partition$

grd012: $processes\_of\_partition(proc) \in dom(current\_partition\_flag)$

grd008: $current\_partition\_flag(part) = TRUE$

grd009: $finished\_core2(core) = FALSE$

grd010: $location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_2$

grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail \mapsto loc\_r$

act002: $finished\_core2(core) := TRUE$

act003: $resource\_become\_avail\_proc := \{core\} \mathbin{⩤} resource\_become\_avail\_proc$

end

Event resource_become_available2_init ⟨ordinary⟩ $\widehat{=}$

extends resource_become_available2

any

part

procs

newstates

core

where

grd001: $part \in PARTITIONS$

grd002: $procs \subseteq processes \cap dom(process\_state)$

grd003: $newstates \in procs \rightarrow PROCESS\_STATES$

grd004: $core \in CORES$

grd005: $procs \subseteq processes\_of\_partition^{-1}[\{part\}]$

grd101: $partition\_mode(part) = PM\_NORMAL$

grd102: $\forall proc\cdot(proc \in procs \Rightarrow process\_state(proc) = PS\_Waiting \lor process\_state(proc) = PS\_WaitandSuspend)$

grd103: $\forall proc\cdot(proc \in procs \land process\_state(proc) = PS\_Waiting \Rightarrow newstates(proc) = PS\_Ready)$

grd104: $\forall proc\cdot(proc \in procs \land process\_state(proc) = PS\_WaitandSuspend \Rightarrow newstates(proc) = PS\_Suspend)$

grd301: $part = current\_partition$

grd303: $part \in dom(current\_partition\_flag)$

grd302: $current\_partition\_flag(part) = TRUE$

grd304: $finished\_core2(core) = TRUE$

then

act001: $process\_state := process\_state \mathbin{\lhd\mkern-14mu-} newstates$

act301: $location\_of\_service2(core) := Resource\_become\_avail2 \mapsto loc\_i$

act302: $finished\_core2(core) := FALSE$

act303: $resource\_become\_avail2(core) := procs$

act304: $timeout\_trigger := procs \mathbin{⩤} timeout\_trigger$

end

Event resource_become_available2_timeout_trig ⟨ordinary⟩ $\widehat{=}$

any

part

procs

core

where

grd001: $part \in PARTITIONS$

grd002: $procs \subseteq (processes \cap dom(process\_state))$

grd003: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(resource\_become\_avail2)$

grd004: $procs = resource\_become\_avail2(core)$

grd005: $part = current\_partition$

grd006: $partition\_mode(part) = PM\_NORMAL$

grd007: $\forall proc\cdot(proc \in procs \land proc \in dom(process\_wait\_type) \Rightarrow process\_wait\_type(proc) = PROC\_WAIT\_OBJ)$

grd008: $finished\_core2(core) = FALSE$

grd009: $location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_i$

grd010: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_i)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail2 \mapsto loc\_1$

act002: $process\_wait\_type := procs \mathbin{⩤} process\_wait\_type$

end

Event resource_become_available2_schedule ⟨ordinary⟩ $\widehat{=}$

any

part

procs

core

resch

where

grd001: $part \in PARTITIONS$

grd002: $procs \subseteq (processes \cap dom(process\_state))$

grd003: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(resource\_become\_avail2)$

grd004: $procs = resource\_become\_avail2(core)$

grd005: $part = current\_partition$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd008: $resch \in BOOL$
grd009: $finished\_core2(core) = FALSE$
grd010: $location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_1$
grd011: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_1)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail2 \mapsto loc\_2$
act002: $need\_reschedule := resch$

end

Event resource_become_available2_return ⟨ordinary⟩ $\widehat{=}$

any

part
procs
core

where

grd001: $part \in PARTITIONS$
grd002: $procs \subseteq (processes \cap dom(process\_state))$
grd003: $core \in CORES \land core \in dom(location\_of\_service2) \land core \in dom(resource\_become\_avail2)$

grd004: $procs = resource\_become\_avail2(core)$
grd005: $part = current\_partition$
grd006: $partition\_mode(part) = PM\_NORMAL$
grd007: $finished\_core2(core) = FALSE$
grd008: $location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_2$
grd009: $\neg(finished\_core2(core) = FALSE \land location\_of\_service2(core) = Resource\_become\_avail2 \mapsto loc\_2)$

then

act001: $location\_of\_service2(core) := Resource\_become\_avail2 \mapsto loc\_r$
act002: $finished\_core2(core) := TRUE$
act003: $resource\_become\_avail2 := \{core\} \lhd resource\_become\_avail2$

end

Event periodicproc_reach_releasepoint ⟨ordinary⟩ $\widehat{=}$

extends periodicproc_reach_releasepoint

any

part
proc
newstate
core

where

grd001: $part \in PARTITIONS$
grd002: $proc \in processes \cap dom(processes\_of\_partition) \cap dom(process\_state) \cap dom(periodtype\_of\_process)$

grd003: $newstate \in PROCESS\_STATES$
grd004: $core \in CORES$
grd005: $processes\_of\_partition(proc) = part$
grd101: $partition\_mode(part) = PM\_NORMAL$
grd102: $periodtype\_of\_process(proc) = PERIOD\_PROC$
grd103: $process\_state(proc) = PS\_Waiting$
grd104: $newstate = PS\_Ready$
grd204: $proc \in dom(period\_of\_process) \land proc \in dom(releasepoint\_of\_process) \land proc \in dom(process\_wait\_type)$

grd205: $proc \in dom(timecapacity\_of\_process) \land proc \in dom(deadlinetime\_of\_process)$
grd201: $period\_of\_process(proc) \neq INFINITE\_TIME\_VALUE$
grd202: $clock\_tick * ONE\_TICK\_TIME \geq releasepoint\_of\_process(proc)$
grd203: $process\_wait\_type(proc) = PROC\_WAIT\_PERIOD$

then

act001: $process\_state(proc) := newstate$

act201: $timeout\_trigger := \{proc\} \domsub timeout\_trigger$
act202: $releasepoint\_of\_process(proc) := releasepoint\_of\_process(proc) + period\_of\_process(proc)$
act203: $deadlinetime\_of\_process(proc) := releasepoint\_of\_process(proc) + timecapacity\_of\_process(proc)$

end

END