─────────────── MODULE *P0Finish* ───────────────

Resilient *place*0 finish (see *FinishResilientPlace*0.*x*10) Limitations: (1) *p*0 resilient store uses an implicit immediate thread

       (2) we don't globalize long chains of local finishes, only the direct local parent is globalized when the child goes global

       (3) *PushException* not implemented yet

EXTENDS *Integers*, *Sequences*
CONSTANTS *PLACE*, *MXFINISHES*, *PROG_HOME*, *MXTHREADS*, *NBLOCKS*, *MXSTMTS*
VARIABLES *fid*, *fstates*, *msgs*, *thrds*, *p0fstates*, *pstate*, *isDead*, *mseq*, *p0adoptSet*
INSTANCE *Commons*

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$Alloc(type, here, parent, root) \triangleq$
    $\wedge fstates[fid].status =$ "unused"
    $\wedge fstates' = [fstates$ EXCEPT $![fid].id = fid,$
                     $!$ $[fid].count = 1,$ one
                     $!$ $[fid].status =$ "waiting",
                     $!$ $[fid].type = type,$
                     $!$ $[fid].here = here,$
                     $!$ $[fid].parent = parent,$
                     $!$ $[fid].root = root,$
                     $!$ $[fid].isGlobal =$ IF $type =$ "p0remote"
                                       THEN TRUE
                                       ELSE FALSE$]$

$SendTransit(dst) \triangleq$
    $\wedge dst \neq fstates[fid].here$
    $\wedge$ LET $parentId \triangleq fstates[fid].parent$
          $here \triangleq fstates[fid].here$
          $root \triangleq fstates[fid].root$
          $rootPlace \triangleq GetFinishHome(fstates[fid].root)$
    IN $\wedge SendMsg([mid \mapsto mseq,$
                      $src \mapsto here,$
                      $dst \mapsto PROG\_HOME,$
                   $target \mapsto dst,$
                      $fid \mapsto root,$
                    $pfid \mapsto parentId,$
                    $rfid \mapsto root,$
                    $rpl \mapsto rootPlace,$
                    $type \mapsto$ "transit"$])$
          $\wedge mseq' = mseq + 1$

$SendTransitToLive(src, actId, inMsg) \triangleq$
    $\wedge ReplaceMsg(inMsg,$
            $[mid \mapsto mseq,$
        $src \mapsto src,$
        $dst \mapsto PROG\_HOME,$

1

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\begin{aligned}
&\quad target \mapsto fstates[fid].here, \\
&\qquad fid \ \mapsto fstates[fid].root, \quad \text{[always refer to the root state]} \\
&\qquad aid \mapsto actId, \\
&\qquad type \mapsto \text{"live"}]) \\
&\land mseq' = mseq + 1
\end{aligned}
$$

$SendLiveToCompleted \triangleq$
$\quad \land SendMsg([mid \mapsto mseq,$
$\qquad\qquad\qquad src \mapsto fstates[fid].here,$
$\qquad\qquad\qquad dst \mapsto PROG\_HOME,$
$\qquad\qquad target \ \ \mapsto fstates[fid].here,$
$\qquad\qquad\quad fid \quad \mapsto fstates[fid].root,$ [always refer to the root state]
$\qquad\qquad\quad type \quad \mapsto \text{"completed"}])$
$\quad \land mseq' = mseq + 1$

$NotifySubActivitySpawn(dst) \triangleq$
$\quad \text{LET } parentId \triangleq fstates[fid].parent$
$\quad \text{IN} \quad \land \text{IF } parentId \neq NoParent$
$\qquad\qquad \text{THEN } fstates' = [fstates \text{ EXCEPT } ![fid].isGlobal = \text{TRUE},$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad ![parentId].isGlobal = \text{TRUE}]$
$\qquad\qquad \text{ELSE } \ fstates' = [fstates \text{ EXCEPT } ![fid].isGlobal = \text{TRUE}]$
$\qquad\quad \land SendTransit(dst)$

$NotifySubActivitySpawnError(dst) \triangleq \text{FALSE}$

$NotifyLocalActivitySpawnAndCreation(here, act) \triangleq$
$\quad \land fstates' = [fstates \text{ EXCEPT } ![fid].count = @ + 1]$

$NotifyRemoteActivityCreation(src, act, inMsg) \triangleq$
$\quad \land SendTransitToLive(src, act.aid, inMsg)$
$\quad \land fstates' = fstates$

$LastActivity \triangleq$
$\quad \land fstates[fid].count = 1$

$NotifyActivityTermination \triangleq$
$\quad \land fstates[fid].count > 0$
$\quad \land \text{IF } LastActivity$
$\qquad \text{THEN } fstates' = [fstates \text{ EXCEPT } ![fid].count = @ - 1,$
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad ![fid].status = \text{"finished"}]$
$\qquad \text{ELSE } \ fstates' = [fstates \text{ EXCEPT } ![fid].count = @ - 1]$

$PushException(e) \triangleq$
$\quad \text{FALSE}$

$SendTermMsg \triangleq$

IF $\neg fstates[fid].isGlobal$
   THEN $\land fstates' = [fstates \text{ EXCEPT } ![fid].status = \text{"forgotten"}]$
         $\land msgs' = msgs$
         $\land mseq' = mseq$
   ELSE $\land SendLiveToCompleted$
         $\land fstates' = [fstates \text{ EXCEPT } ![fid].status = \text{IF } fstates[fid].type = \text{"p0remote"}$
                                                            $\text{THEN } \text{"forgotten"}$
                                                            $\text{ELSE } \text{"p0finished"}]$

$ProcessChildTermMsg(msg) \triangleq$
   FALSE

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3