MODULE *AbsJupiter*

Abstract *Jupiter*, inspired by the COT algorithm proposed by Sun and Sun; see *TPDS'*2009.

EXTENDS *JupiterSerial*, *SetStateSpace*

VARIABLES

copss *copss*[*r*]: the state space (*i.e.*, a set) of *Cop* maintained at replia $r \in Replica$

$vars \triangleq \langle intVars,\ ctxVars,\ serialVars,\ copss \rangle$

$TypeOK \triangleq$
- $\land$ *TypeOKInt*
- $\land$ *TypeOKCtx*
- $\land$ *TypeOKSerial*
- $\land$ $copss \in [Replica \to \text{SUBSET } Cop]$

$Init \triangleq$
- $\land$ *InitInt*
- $\land$ *InitCtx*
- $\land$ *InitSerial*
- $\land$ $copss = [r \in Replica \mapsto \{\}]$

$NextCop(r,\ cop,\ ss,\ ctx) \triangleq$ Return the next $fcop \in Cop$ against which cop is to be transformed.

LET $foid \triangleq$ CHOOSE $oid \in ctx :$ the first *oid* in *ctx* according to $serial[r]$

$\forall\, id \in ctx \setminus \{oid\} : tb(oid,\ id,\ serial[r])$

IN CHOOSE $fcop \in ss :$ THEOREM : Existence of *fcop*

$fcop.oid = foid \land fcop.ctx = cop.ctx$

$Perform(r,\ cop) \triangleq$

LET $xform \triangleq xForm(NextCop,\ r,\ cop,\ copss[r])$ [*xcop*, *xss*]

IN $\land\ copss' = [copss \text{ EXCEPT } ![r] = xform.xss]$

$\land\ SetNewAop(r,\ xform.xcop.op)$

$ClientPerform(c,\ cop) \triangleq Perform(c,\ cop)$

$ServerPerform(cop) \triangleq$
- $\land$ $Perform(Server,\ cop)$
- $\land$ $Comm!SSendSame(ClientOf(cop),\ cop)$

$DoOp(c,\ op) \triangleq$

LET $cop \triangleq [op \mapsto op,\ oid \mapsto [c \mapsto c,\ seq \mapsto cseq[c]],\ ctx \mapsto ds[c]]$

IN $\land\ ClientPerform(c,\ cop)$

$\land\ Comm!CSend(cop)$

$Do(c) \triangleq$
- $\land$ $DoInt(DoOp,\ c)$
- $\land$ $DoCtx(c)$

$\land\ DoSerial(c)$

$Rev(c) \triangleq$
$\land\ RevInt(ClientPerform,\ c)$
$\land\ RevCtx(c)$
$\land\ RevSerial(c)$

$SRev \triangleq$
$\land\ SRevInt(ServerPerform)$
$\land\ SRevCtx$
$\land\ SRevSerial$

$Next \triangleq$
$\lor \exists\, c \in Client : Do(c) \lor Rev(c)$
$\lor\ SRev$

$Fairness \triangleq$
$\mathrm{WF}_{vars}(SRev \lor \exists\, c \in Client : Rev(c))$

$Spec \triangleq Init \land \Box[Next]_{vars}$ $\land\ Fairness$

$QC \triangleq$ Quiescent Consistency
$Comm!EmptyChannel \Rightarrow Cardinality(Range(state)) = 1$
THEOREM $Spec \Rightarrow \Box QC$

$SEC \triangleq$ Strong Eventual Consistency
$\forall\, r1,\ r2 \in Replica :$
$ds[r1] = ds[r2] \Rightarrow state[r1] = state[r2]$
THEOREM $Spec \Rightarrow \Box SEC$

$Compactness \triangleq$ Compactness of state space
$Comm!EmptyChannel \Rightarrow Cardinality(Range(copss)) = 1$
THEOREM $Spec \Rightarrow \Box Compactness$

---

* Modification History
* Last modified *Tue Jan* 29 10:11:54 *CST* 2019 by *hengxin*
* Created *Wed Dec* 05 19:55:52 *CST* 2018 by *hengxin*