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──────────────────────── MODULE CJupiter ────────────────────────
Specification of our own CJupiter protocol; see Wei@OPODIS′2018.
EXTENDS JupiterSerial, GraphStateSpace
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VARIABLES
    css      css[r]: the n-ary ordered state space at replica r ∈ Replica

vars ≜ ⟨intVars, ctxVars, serialVars, css⟩
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TypeOK ≜
    ∧   TypeOKInt
    ∧   TypeOKCtx
    ∧   TypeOKSerial
    ∧   ∀ r ∈ Replica : IsSS(css[r])
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Init ≜
    ∧ InitInt
    ∧ InitCtx
    ∧ InitSerial
    ∧ css = [r ∈ Replica ↦ EmptySS]
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NextEdge(r, u, ss) ≜    Return the first outgoing edge from u in ss at replica r
    CHOOSE e ∈ ss.edge :
        ∧ e.from = u
        ∧ ∀ ue ∈ ss.edge \ {e} :
            (ue.from = u) ⇒ tb(e.cop.oid, ue.cop.oid, serial[r])

Perform(r, cop) ≜
    LET xform ≜ xForm(NextEdge, r, cop, css[r])    xform: [xcop, xss, lss]
    IN    ∧ css′ = [css EXCEPT ![r] = @ ⊕ xform.xss]
          ∧ SetNewAop(r, xform.xcop.op)

ClientPerform(c, cop) ≜ Perform(c, cop)

ServerPerform(cop) ≜
    ∧ Perform(Server, cop)
    ∧ Comm!SSendSame(ClientOf(cop), cop)    broadcast the original cop
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DoOp(c, op) ≜
      LET cop ≜ [op ↦ op, oid ↦ [c ↦ c, seq ↦ cseq[c]], ctx ↦ ds[c]]
       IN   ∧ ClientPerform(c, cop)
            ∧ Comm!CSend(cop)

Do(c) ≜
      ∧ DoInt(DoOp, c)
      ∧ DoCtx(c)
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$\quad \land DoSerial(c)$

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

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

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

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

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

$Compactness \triangleq$ Compactness of *CJupiter*: the *CSSes* at all replicas are the same.
$\quad Comm!EmptyChannel \Rightarrow Cardinality(Range(css)) = 1$

THEOREM $Spec \Rightarrow \Box Compactness$

\* Modification History
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