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1  |----- MODULE JupiterSerial -----|
   | Specification of serial views used by AbsJupiter and CJupiter. |
5  | EXTENDS JupiterCtx |
6  |-----|
7  VARIABLES
8      serial, serial[r]: the serial view of replica  $r \in \text{Replica}$  about the serialization order established at the Server
9      cincomingSerial, sincomingSerial

11 serialVars  $\triangleq \langle \text{serial}, \text{cincomingSerial}, \text{sincomingSerial} \rangle$ 
12 commSerial  $\triangleq$  INSTANCE CSComm WITH Msg  $\leftarrow \text{Seq}(\text{Oid})$ ,
13      cincoming  $\leftarrow \text{cincomingSerial}$ , sincoming  $\leftarrow \text{sincomingSerial}$ 
14 |-----|
15 tb(cop1, cop2, sv)  $\triangleq$  Is cop1 totally ordered before cop2 according to the serial view (sv) of some replica?
16     LET pos1  $\triangleq \text{FirstIndexOfElementSafe}(\text{sv}, \text{cop1})$ 
17     pos2  $\triangleq \text{FirstIndexOfElementSafe}(\text{sv}, \text{cop2})$ 
18     IN IF pos1  $\neq 0 \wedge \text{pos2} \neq 0$  at the server or both are remote operations
19         THEN pos1 < pos2
20     ELSE IF pos1 = 0  $\wedge \text{pos2} = 0$  at a client: both are local operations (not happen in CJupiter)
21         THEN cop1.seq < cop2.seq
22     ELSE pos1  $\neq 0$  at a client: one is a remote operation and the other is a local operation
23 |-----|
24 TypeOKSerial  $\triangleq$ 
25      $\wedge \text{serial} \in [\text{Replica} \rightarrow \text{Seq}(\text{Oid})]$ 
26      $\wedge \text{commSerial}! \text{TypeOK}$ 

28 InitSerial  $\triangleq$ 
29      $\wedge \text{serial} = [r \in \text{Replica} \mapsto \langle \rangle]$ 
30      $\wedge \text{commSerial}! \text{Init}$ 

32 DoSerial(c)  $\triangleq$ 
33     UNCHANGED serialVars

35 RevSerial(c)  $\triangleq$ 
36      $\wedge \text{commSerial}! \text{CRev}(\text{c})$ 
37      $\wedge \text{serial}' = [\text{serial} \text{ EXCEPT } ![c] = \text{Head}(\text{cincomingSerial}[c])]$ 

39 SRevSerial  $\triangleq$ 
40      $\wedge \text{LET } \text{cop} \triangleq \text{Head}(\text{sincoming})$ 
41     IN  $\wedge \text{serial}' = [\text{serial} \text{ EXCEPT } ![Server] = \text{Append}(@, \text{cop.oid})]$ 
42      $\wedge \text{commSerial}! \text{SSendSame}(\text{cop.oid.c}, \text{serial}'[Server])$ 
43      $\wedge \text{UNCHANGED } \text{sincomingSerial}$ 
44 |-----|

\ * Modification History
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