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1  ┌────────────────────────── MODULE AbsJupiter ───────────────────┐
    Abstract Jupiter
6  EXTENDS Naturals, Order, AdditionalSequenceOperators

8  CONSTANTS
9      Client, the set of client replicas
10     Server, the unique server replica
11     O, the set of original operations
12     co, the client order in which each client generates its operations
13     so, the server order in which the server processes operations
14     hb the happened-before relation

16     Replica  $\triangleq$  Client  $\cup$  {Server} all replicas
17     sigma  $\triangleq$  [O  $\mapsto$  O, co  $\mapsto$  co, so  $\mapsto$  so, hb  $\mapsto$  hb] the schedule

19  ASSUME
20       $\wedge O \subseteq Client \times Nat$  oid = (c, n)
21       $\wedge co \in [Client \rightarrow Seq(O)]$  strict total order (for each client) represented by sequence
22       $\wedge so \in Seq(O)$  strict total order represented by sequence
23       $\wedge hb \subseteq O \times O$  strict partial order

    The restriction of co to operations generated by c  $\in$  Client.
28     R | c  $\triangleq$  {o1, o2}  $\in$  R : o1.c = c  $\wedge$  o2.c = c}

30     Res(csched, oset)  $\triangleq$ 
31         [O  $\mapsto$  oset, co  $\mapsto$  Retain(csched.co, oset), so  $\mapsto$  Retain(csched.so, oset),
32         hb  $\mapsto$  csched.hb | oset]

    Determine the eo order at client c
37  RECURSIVE EOR(-)
38     EOR(csigma)  $\triangleq$ 
39         IF PrintT(csigma)  $\wedge$  csigma.co =  $\langle \rangle$ 
40         THEN csigma.so
41         ELSE LET o  $\triangleq$  Head(csigma.co)
42                 hbo  $\triangleq$  LT(hb, o) the set of operation happened-before o
43                 IN Retain(csigma.so, hbo)
44                      $\circ$   $\langle o \rangle$ 
45                      $\circ$  EOR(Res(csigma, csigma.O  $\setminus$  {hbo, o}))

    eo: execution order, a function mapping each replica r  $\in$  Replica to the order in which the
    operations are processed at each r.
51     eo  $\triangleq$  [r  $\in$  Replica  $\mapsto$ 
52         IF r = Server
53         THEN so
54         ELSE EOR([sigma EXCEPT !.co = @[r]])
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