1 ⎯⎯⎯⎯⎯⎯⎯⎯ MODULE $XJupiterImplCJupiter$ ⎯⎯⎯⎯⎯⎯⎯⎯

In this module, we show that *XJupiter* implements *CJupiter*. To this end, we first extends *XJupiter* by replace its *Cop* with that used in *CJupiter*.

7 EXTENDS $XJupiterExtended$

9 VARIABLES
10     $cincomingCJ$,   *cincoming* for *CJupiter* which contains original operations
11   instead of transformed ones in *XJupiter*
12     $cxss$ $cxss[c]$: *eXtra ss* created during *OT* at the *Server* for client $c \in Client$

14 $varsImpl \triangleq \langle vars,\ cincomingCJ,\ cxss \rangle$

The *Init* predicate.

19 $InitImpl \triangleq$
20     $\wedge\ Init$
21     $\wedge\ cincomingCJ = [c \in Client \mapsto \langle\rangle]$
22     $\wedge\ cxss = [c \in Client \mapsto [node \mapsto \{\{\}\},\ edge \mapsto \{\}]]$

24 $DoImpl(c) \triangleq$
25     $\wedge\ Do(c)$
26     $\wedge$ UNCHANGED $\langle cincomingCJ,\ cxss \rangle$

28 $RevImpl(c) \triangleq$
29     $\wedge\quad Rev(c)$
30     $\wedge\quad cincomingCJ[c] \neq \langle\rangle$ there are (original) operations to handle with
31     $\wedge\quad cincomingCJ' = [cincomingCJ$ EXCEPT $![c] = Tail(@)]$ also consume a message
32     $\wedge\quad$ UNCHANGED $\langle cxss \rangle$

Also broadcast the original operation to clients (using the *cincomingCJ* channels)

37 $SRevImpl \triangleq$
38     $\wedge\ SRev$
39     $\wedge$ LET $cop \triangleq [Head(sincoming)$ EXCEPT $!.sctx = soids]$
40               $c \triangleq cop.oid.c$
41            $ss \triangleq xForm(cop,\ sss[c],\ scur[c],\ Remote)$
42   IN $\wedge\ cincomingCJ' = [cl \in Client \mapsto$
43   IF $cl = c$
44   THEN $cincomingCJ[cl]$
45   ELSE $\ Append(cincomingCJ[cl],\ cop)]$
46           $\wedge\ cxss' = [cl \in Client \mapsto$
47   IF $cl = c$
48   THEN $cxss[cl]$
49   ELSE $[cxss[cl]$ EXCEPT $!.node = @ \cup Range(ss.node),$
50 $!.edge = @ \cup Range(ss.edge)]]$

The next-state relation.

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55   $NextImpl \triangleq$
56       $\lor \exists\, c \in Client : DoImpl(c) \lor RevImpl(c)$
57       $\lor\ SRevImpl$

The specification.

62   $SpecImpl \triangleq InitImpl \land \Box[NextImpl]_{varsImpl} \land \mathrm{WF}_{varsImpl}(NextImpl)$

64   $ss1 \oplus ss2 \triangleq$
65     $[ss1\ \text{EXCEPT}\ !.node = @ \cup ss2.node,$
66                  $!.edge\ = @ \cup ss2.edge]$

68   $IgnoreDir(ss) \triangleq$
69     $[ss\ \text{EXCEPT}\ !.edge =$
70       $[field \in (\text{DOMAIN}\ e \setminus \{\text{"lr"}\}) \mapsto e.field]$
71      $\{[from \mapsto e.from,\ to \mapsto e.to,\ cop \mapsto e.cop] : e \in @\}]$

73   $CJ \triangleq \text{INSTANCE}\ CJupiter\ \text{WITH}\ cincoming \leftarrow cincomingCJ,$
74         $css \leftarrow [r \in Replica \mapsto$
75                $\text{IF}\ r = Server$
76                 $\text{THEN}\ IgnoreDir(SetReduce(\oplus,\ Range(sss),\ [node \mapsto \{\{\}\},\ edge \mapsto \{\}]))$
77                 $\text{ELSE}\ \ IgnoreDir(css[r] \oplus cxss[r])],$
78         $cur \leftarrow [r \in Replica \mapsto$
79                $\text{IF}\ r = Server$
80   It SHOULD be that $Cardinality(Range(scur)) = 1$
81                 $\text{THEN}\ \text{CHOOSE}\ n \in Range(scur) : \text{TRUE}$
82                 $\text{ELSE}\ \ ccur[r]]$

84   $\text{THEOREM}\ SpecImpl \Rightarrow CJ!Spec$
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