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1  ┌────────────────────────── MODULE BS ───────────────────────────┐
2  EXTENDS FiniteSets, Sequences, Naturals, Integers, TLC, Broadcast, Broadcast2, Reals
4  Sequence to Set
5  RECURSIVE Seq2Set(-)
6  Seq2Set(S)  $\triangleq$ 
7      IF S =  $\langle \rangle$  THEN {}
8      ELSE
9          LET i  $\triangleq$  Head(S)
10         IN  {i}  $\cup$  Seq2Set(Tail(S))

14  VARIABLES broadCastSeq, offset, broadCastCollection
15  vars  $\triangleq$   $\langle$ broadCastSeq, offset, broadCastCollection $\rangle$ 

21  Init  $\triangleq$   $\wedge$  offset = 1
22           $\wedge$  broadCastSeq =  $\langle \rangle$ 
23           $\wedge$  broadCastCollection = {}
24  Trace  $\triangleq$  broadcastparser("D : \ \ 00001code \ \ runtime\ \ \ zookeeper_environment \ \ broadcast.log")
25  Trace2  $\triangleq$  broadcastparser2("D : \ \ 00001code \ \ runtime\ \ \ zookeeper_environment \ \ broadcast.log")
28  Trace  $\triangleq$  broadcastparser("./broadcast.log")
29  Trace2  $\triangleq$  broadcastparser2("./broadcast.log")
30  IsInjective(f)  $\triangleq$   $\forall a, b \in \text{DOMAIN } f : f[a] = f[b] \Rightarrow a = b$ 
31  SetToSeq(S)  $\triangleq$  CHOOSE f  $\in$   $[1 \dots \text{Cardinality}(S) \rightarrow S] : \text{IsInjective}(f)$ 
32  selectLeaderNode(S)  $\triangleq$  CHOOSE temp  $\in$  S :
33           $\wedge$  temp.action = "LeaderLaunchProposal"
34  selectNodeCommitTranslation(S)  $\triangleq$  {temp  $\in$  S :
35           $\wedge$  temp.action = "Request2DataTree"
36          }
37  selectFollowerNode(S)  $\triangleq$  {temp  $\in$  S :
38           $\wedge$  temp.action = "FollowerSendAckToLeader"}

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42 $selectReceivedProposal(S) \triangleq \{temp \in S :$
 43 $\quad \wedge temp.action = \text{"ReceivedProposal"} \}$
 44 $decideWriteRequestTranslationConsistency(writeRequestCollection,$
 45 $\quad NodeCommitTranslationCollection,$
 46 $\quad nodeCount,$
 47 $\quad Request2DataTreeCount) \triangleq$
 48 $\quad \forall commitTranslation \in NodeCommitTranslationCollection :$
 49 $\quad \quad \wedge commitTranslation.sessionid = writeRequestCollection.sessionid$
 50 $\quad \quad \wedge commitTranslation.type = writeRequestCollection.type$
 51 $\quad \quad \wedge commitTranslation.cxid = writeRequestCollection.cxid$
 52 $\quad \quad \wedge commitTranslation.zxidHigh = writeRequestCollection.zxidHigh$
 53 $\quad \quad \wedge commitTranslation.zxidLow = writeRequestCollection.zxidLow$
 54 $\quad \quad \wedge commitTranslation.txntype = writeRequestCollection.txntype$
 55 $\quad \quad \wedge nodeCount = Request2DataTreeCount$
 56 $decideProposalConsistency(SendProposal, ReceivedProposal) \triangleq$
 57 $\quad \forall RP \in ReceivedProposal :$
 58 $\quad \quad \wedge RP.sessionid = SendProposal.sessionid$
 59 $\quad \quad \wedge RP.type = SendProposal.type$
 60 $\quad \quad \wedge RP.cxid = SendProposal.cxid$
 61 $\quad \quad \wedge RP.zxidHigh = SendProposal.zxidHigh$
 62 $\quad \quad \wedge RP.zxidLow = SendProposal.zxidLow$

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89  decideOrder(zxidHigh_1, zxidLow_1, zxidHigh_2, zxidLow_2)  $\triangleq$ 
90
91                                     IF (zxidHigh_1 < zxidHigh_2)
92
93                                     THEN
94
95                                      $\wedge$  TRUE
96
97                                     ELSE
98
99                                      $\wedge$  IF (zxidHigh_1 = zxidHigh_2)
100
101                                     THEN
102
103                                      $\wedge$  IF (zxidLow_1 < zxidLow_2)
104
105                                     THEN
106
107                                      $\wedge$  TRUE
108
109                                     ELSE
110
111                                      $\wedge$  FALSE
112
113                                     ELSE
114
115                                      $\wedge$  FALSE
116
117  globalOrderVerification(S1, S2)  $\triangleq$ 
118
119       $\wedge \forall temp \in S1 :$ 
120
121       $\forall temp\_2 \in S2 :$ 
122
123       $\wedge$  IF ((temp.myId = temp_2.myId))
124
125      THEN
126
127       $\wedge$  decideOrder(temp.zxidHigh, temp.zxidLow,
128
129                    temp_2.zxidHigh, temp_2.zxidLow)
130
131      ELSE
132
133       $\wedge$  TRUE

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162 broadcast  $\triangleq$   $\wedge \text{offset} \leq \text{Len}(\text{Trace})$ 
163            $\wedge \text{offset}' = \text{offset} + 1$ 
164            $\wedge \text{broadcastSeq}' = \text{Trace}[\text{offset}]$ 
165            $\wedge \text{broadcastCollection}' = \text{Seq2Set}(\text{broadcastSeq}')$ 
166            $\wedge \text{Assert}(\text{decideWriteRequestTranslationConsistency}(\text{$ 
167                $\text{selectLeaderNode}(\text{broadcastCollection}')$ ,
168                $\text{selectNodeCommitTranslation}(\text{broadcastCollection}')$ ,
169                $\text{Len}(\text{SetToSeq}(\text{selectFollowerNode}(\text{broadcastCollection}')))) + 1,$ 
170                $\text{Len}(\text{SetToSeq}(\text{selectNodeCommitTranslation}(\text{broadcastCollection}'))))$ 
171                $) = \text{TRUE}, \text{ "WriteTranslationConsistency" })$ 
172            $\wedge \text{Assert}(\text{decideProposalConsistency}(\text{$ 
173                $\text{selectLeaderNode}(\text{broadcastCollection}')$ ,
174                $\text{selectReceivedProposal}(\text{broadcastCollection}') = \text{TRUE},$ 
175                $\text{ "Proposal consistency" })$ 
176            $\wedge \text{IF } ((\text{offset} + 1) \leq \text{Len}(\text{Trace2}))$ 
177               THEN
178                    $\wedge \text{globalOrderVerification}(\text{Trace2}[\text{offset}], \text{Trace2}[\text{offset} + 1])$ 
179               ELSE
180                    $\wedge \text{TRUE}$ 

185 term  $\triangleq$   $\wedge \text{offset} > \text{Len}(\text{Trace})$ 
186            $\wedge \text{UNCHANGED vars}$ 

188 Next  $\triangleq$   $\vee \text{broadcast}$ 
189            $\vee \text{term}$ 

191 Spec  $\triangleq$   $\text{Init} \wedge \square[\text{Next}]_{\text{vars}}$ 

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\ * Modification History
\ * Last modified Fri Mar 18 16:03:26 CST 2022 by 10222803
\ * Created Wed Mar 09 16:58:01 CST 2022 by 10222803

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