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1  |----- MODULE CSComm -----|
   | Specification of communication in a Client-Server system model. |
5  | EXTENDS AdditionalSequenceOperators |
6  |-----|
7  | CONSTANTS
8      Client,      the set of clients
9      Server,      the (unique) server
10     Msg          the set of possible messages
11 |-----|
12 | VARIABLES
13     cincoming,    cincoming[c]: incoming channel at the client c ∈ Client
14     sincoming     incoming channel at the Server
15 |-----|
16 | TypeOK ≜
17     ∧ cincoming ∈ [Client → Seq(Msg)]
18     ∧ sincoming ∈ Seq(Msg)
19 |-----|
   | The initial predicate. |
23 | Init ≜
24     ∧ cincoming = [c ∈ Client ↦ ⟨⟩]
25     ∧ sincoming = ⟨⟩
26 |-----|
   | A client sends a message msg to the Server. |
30 | CSend(msg) ≜
31     ∧ sincoming' = Append(sincoming, msg)
32     ∧ UNCHANGED cincoming
   | A client receives a message from the Server. |
36 | CRev(c) ≜
37     ∧ cincoming[c] ≠ ⟨⟩
38     ∧ cincoming' = [cincoming EXCEPT ![c] = Tail(@)]   consume a message
39     ∧ UNCHANGED sincoming
40 |-----|
   | SRev and SSend below will be used together in one subaction. Therefore, there are no UNCHANGED |
   | sub-formulas in their definitions. |
   | The Server receives a message from some client c ∈ Client. |
49 | SRev ≜
50     ∧ sincoming ≠ ⟨⟩   there are messages for the Server to handle with
51     ∧ sincoming' = Tail(sincoming)   consume a message
   | The Server sends a message to each client other than c ∈ Client. |
55 | SSend(c, cmsg) ≜
56     ∧ cincoming' = [cl ∈ Client ↦
57         IF cl = c
58         THEN cincoming[cl]

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59                                     ELSE Append(cincoming[cl], cmsg[cl]))
    The Server broadcasts the same message to all the Clients other than  $c \in Client$ .
64 SSendSame(c, msg)  $\triangleq$ 
65      $\wedge$  SSend(c, [cl  $\in$  Client  $\mapsto$  msg])
66 |-----|
    Properties of communication.
70 EmptyChannel  $\triangleq$  Init
71 |-----|
    \ * Modification History
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