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1  |----- MODULE CSComm -----|
   | Specification of communication in a Client-Server system model.
5  | EXTENDS AdditionalSequenceOperators
   |-----|
7  | CONSTANTS
8     Client,      the set of clients
9     Server,       the (unique) server
10    Msg           the set of possible messages
   |-----|
12 | VARIABLES
13    cincoming,    cincoming[c]: incoming channel at client c ∈ Client
14    sincoming     incoming channel at the Server
   |-----|
16 | TypeOK ≜
17     ∧ cincoming ∈ [Client → Seq(Msg)]
18     ∧ sincoming ∈ Seq(Msg)
   |-----|
20 | Init ≜
21     ∧ cincoming = [c ∈ Client ↦ ⟨⟩]
22     ∧ sincoming = ⟨⟩
   |-----|
   | A client sends a message msg to the Server.
27 | CSend(msg) ≜
28     ∧ sincoming' = Append(sincoming, msg)
29     ∧ UNCHANGED cincoming
   |-----|
   | Client c receives a message from the Server.
33 | CRev(c) ≜
34     ∧ cincoming[c] ≠ ⟨⟩
35     ∧ cincoming' = [cincoming EXCEPT ![c] = Tail(@)]   consume a message
36     ∧ UNCHANGED sincoming
   |-----|
   | SRev/SSend below is often used as a subaction. No UNCHANGED in their definitions.
   | The Server receives a message.
45 | SRev ≜
46     ∧ sincoming ≠ ⟨⟩
47     ∧ sincoming' = Tail(sincoming)   consume a message
   |-----|
   | The Server sends a message cmsg to each client other than c ∈ Client.
51 | SSend(c, cmsg) ≜
52     ∧ cincoming' = [cl ∈ Client ↦
53         IF cl = c
54         THEN cincoming[cl]
55         ELSE Append(cincoming[cl], cmsg[cl])]
   |-----|
   | The Server broadcasts the same message msg to all Clients other than c ∈ Client.

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59  $SSendSame(c, msg) \triangleq$ 
60    $\wedge SSend(c, [cl \in Client \mapsto msg])$ 
61 |-----|
62 | Properties of communication channels.
63 |-----|
65  $EmptyChannel \triangleq Init$ 
66 |-----|
  \ * Modification History
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