

```

1 |----- MODULE CComm -----|
2 | EXTENDS SequenceUtils         |
3 |-----|
4 | CONSTANTS                     |
5 |   Client, the set of clients   |
6 |   Server, the (unique) server  |
7 |   Msg, the set of messages     |
8 |-----|
9 | VARIABLES                     |
10 |   cincoming, cincoming[c]: incoming channel at client  $c \in Client$  |
11 |   sincoming, incoming channel at the Server |
12 |-----|
13 | TypeOK  $\triangleq$               |
14 |    $\wedge$  cincoming  $\in [Client \rightarrow Seq(Msg)]$  |
15 |    $\wedge$  sincoming  $\in Seq(Msg)$  |
16 |-----|
17 | Init  $\triangleq$                 |
18 |    $\wedge$  cincoming =  $[c \in Client \mapsto \langle \rangle]$  |
19 |    $\wedge$  sincoming =  $\langle \rangle$  |
20 |-----|
21 | EmptyChannel  $\triangleq$  Init |
22 |-----|
23 | CSend(msg)  $\triangleq$  A client sends a message msg to the Server. |
24 |    $\wedge$  sincoming' = Append(sincoming, msg) |
25 |    $\wedge$  UNCHANGED cincoming |
26 |-----|
27 | CRev(c)  $\triangleq$  Client c receives and consumes a message from the Server. |
28 |    $\wedge$  cincoming[c]  $\neq \langle \rangle$  |
29 |    $\wedge$  cincoming' = [cincoming EXCEPT ![c] = Tail(@)] |
30 |    $\wedge$  UNCHANGED sincoming |
31 |-----|
32 | SRev  $\triangleq$  The Server receives and consumes a message. |
33 |    $\wedge$  sincoming  $\neq \langle \rangle$  |
34 |    $\wedge$  sincoming' = Tail(sincoming) |
35 |-----|
36 | SSend(c, cmsg)  $\triangleq$  The Server sends a message cmsg to each client other than  $c \in Client$ . |
37 |    $\wedge$  cincoming' = [cl  $\in Client \mapsto$  IF cl = c |
38 |                                     THEN cincoming[cl] |
39 |                                     ELSE Append(cincoming[cl], cmsg[cl])] |
40 |-----|
41 | SSendSame(c, msg)  $\triangleq$  The Server broadcasts the message msg to all clients other than  $c \in Client$ . |
42 |    $\wedge$  SSend(c, [cl  $\in Client \mapsto$  msg]) |
43 |-----|

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\ * Modification History
 \ * Last modified Thu Jan 03 13:27:34 CST 2019 by hengxin
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