

MODULE <i>CSComm</i>	
EXTENDS <i>SequenceUtils</i>	
CONSTANTS	
<i>Client</i> ,	the set of clients
<i>Server</i> ,	the (unique) server
<i>Msg</i>	the set of messages
VARIABLES	
<i>cincoming</i> ,	<i>cincoming</i> [<i>c</i>]: incoming <i>FIFO</i> channel at client <i>c</i> ∈ <i>Client</i>
<i>sincoming</i>	incoming <i>FIFO</i> channel at the <i>Server</i>
$TypeOK \triangleq$ $\wedge \quad cincoming \in [Client \rightarrow Seq(Msg)]$ $\wedge \quad sincoming \in Seq(Msg)$	
$Init \triangleq$ $\wedge \quad cincoming = [c \in Client \mapsto \langle \rangle]$ $\wedge \quad sincoming = \langle \rangle$	
$EmptyChannel \triangleq Init$	
$CSend(m) \triangleq$ A client sends a message <i>m</i> to the <i>Server</i> . $\wedge \quad sincoming' = Append(sincoming, m)$ $\wedge \text{UNCHANGED } cincoming$	
$CRev(c) \triangleq$ Client <i>c</i> receives and consumes a message from the <i>Server</i> . $\wedge \quad cincoming[c] \neq \langle \rangle$ $\wedge \quad cincoming' = [cincoming \text{ EXCEPT } ![c] = Tail(@)]$ $\wedge \text{UNCHANGED } sincoming$	
$SRev \triangleq$ The <i>Server</i> receives and consumes a message. $\wedge \quad sincoming \neq \langle \rangle$ $\wedge \quad sincoming' = Tail(sincoming)$	
$SSend(c, cm) \triangleq$ The <i>Server</i> sends a message <i>cm</i> [<i>cl</i>] to client <i>cl</i> (other than <i>c</i>). $cincoming' = [cl \in Client \mapsto \text{IF } cl = c \text{ THEN } cincoming[cl]$ <div style="text-align: right;">$\text{ELSE } Append(cincoming[cl], cm[cl])]$</div>	
$SSendSame(c, m) \triangleq$ The <i>Server</i> broadcasts the message <i>m</i> to all clients other than <i>c</i> . $SSend(c, [cl \in Client \mapsto m])$	
$SSendSameAck(c, mc, mo) \triangleq$ The <i>Server</i> sends <i>mc</i> to <i>c</i> and <i>mo</i> to other clients. $cincoming' = [cl \in Client \mapsto \text{IF } cl = c \text{ THEN } Append(cincoming[cl], mc)$ <div style="text-align: right;">$\text{ELSE } Append(cincoming[cl], mo)]$</div>	
\ * Modification History	

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