

VARIABLES *cbuf*, *crc*, *sbuf*, *srec*

$AJMsg \triangleq [c : Client, ack : Nat, op : Op \cup \{Nop\}] \cup$ from client *c* to Server
 $[ack : Nat, op : Op \cup \{Nop\}]$ from Server to clients

$Do(c, op) \triangleq \wedge cbuf' = [cbuf \text{ EXCEPT } ![c] = Append(@, op)]$
 $\wedge crc' = [crc \text{ EXCEPT } ![c] = 0]$
 \wedge apply *op* to *list*[*c*]
 \wedge send $[c \mapsto c, ack \mapsto crc[c], op \mapsto op]$ to the Server

$Rev(c, m) \triangleq \text{LET } xform \triangleq xFormShift(m.op, cbuf[c], m.ack)$
 $xform : [xop, xops]$

IN $\wedge cbuf' = [cbuf \text{ EXCEPT } ![c] = xform.xops]$
 $\wedge crc' = [crc \text{ EXCEPT } ![c] = @ + 1]$
 \wedge apply *xform.xop* to *list*[*c*]

$SRev(m) \triangleq \text{LET } c \triangleq m.c$
 $xform \triangleq xFormShift(m.op, sbuf[c], m.ack)$ $xform : [xop, xops]$
 $xop \triangleq xform.xop$

IN $\wedge srec' = [cl \in Client \mapsto$
 $\text{IF } cl = c \text{ THEN } srec[cl] + 1 \text{ ELSE } 0]$
 $\wedge sbuf' = [cl \in Client \mapsto$
 $\text{IF } cl = c \text{ THEN } xform.xops$
 $\text{ELSE } Append(sbuf[cl], xop)]$
 \wedge apply *xop* to *list*[Server]
 \wedge send $[ack \mapsto srec[cl], op \mapsto xop]$ to client $cl \neq c$