

Causal Multicast: Updating Rules

- Send multicast at process P_j :
 - Set $P_j[j] = P_j[j] + 1$
 - Include new entire vector $P_j[1 \dots N]$ in multicast message as its sequence number
- Receive multicast: If P_i receives a multicast from P_j with vector $M[1 \dots N]$ ($= P_j[1 \dots N]$) in message, buffer it until both:
 1. This message is the next one P_i is expecting from P_j , i.e.,
 - $M[j] = P_i[j] + 1$
 2. All multicasts, anywhere in the group, which happened-before M have been received at P_i , i.e.,
 - For all $k \neq j$: $M[k] \leq P_i[k]$
 - i.e., *Receiver satisfies causality*
 3. When above two conditions satisfied, deliver M to application and set $P_i[j] = M[j]$