MODULE *Broadcast*

The specification caputers the *DAG* base best effort broadcast to disseminate shares over a peer to peer network.

First pass - We assume no processes failures or messages lost.

EXTENDS *Naturals*, *Sequences*

CONSTANT

$Proc,$ Set of processes
$Data,$
$Nbrs$

VARIABLES

$sent,$ Set of messages sent by processes to their neighbours
$recv$ Set of messages received by processes

$$Message \triangleq [from : Proc,\ data : Data]$$

$$\begin{aligned} &Init \triangleq \\ &\quad \land\ sent = [m \in Message \mapsto \{\}] \\ &\quad \land\ recv = [m \in Message \mapsto \{\}] \end{aligned}$$

$$\begin{aligned} &TypeInvariant \triangleq \\ &\quad \land\ sent \in [Message \rightarrow Proc] \\ &\quad \land\ recv \in [Message \rightarrow Proc] \end{aligned}$$

Send(m, p) - send message m to neighbour q

$$\begin{aligned} &Send(m,\ p) \triangleq \\ &\qquad \land\ m.from \neq p \\ &\qquad \land\ m.from \notin sent[m] \\ &\qquad \land\ \langle m.from,\ p\rangle \in Nbrs \\ &\qquad \land\ sent' = [sent\ \text{EXCEPT}\ ![m] = @ \cup \{p\}] \\ &\qquad \land\ \text{UNCHANGED}\ \langle recv \rangle \end{aligned}$$

Recv(m, q) - receive message m at q. This can be received from forwards

$$\begin{aligned} &Recv(m,\ q) \triangleq \\ &\qquad \land\ q \notin recv[m] \\ &\qquad \land\ recv' = [recv\ \text{EXCEPT}\ ![m] = @ \cup \{q\}] \\ &\qquad \land\ \text{UNCHANGED}\ \langle sent \rangle \end{aligned}$$

Forward(m, p, q) - forward message m from p to q

- enabling condition - m has been sent by some process, q has received the message, q is not the sender
- effect - p forwards the message m to its nbrs

$$\begin{aligned} &Forward(m,\ p,\ q) \triangleq \\ &\qquad \land\ p \neq q \end{aligned}$$

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            $\land \langle p, q \rangle \in Nbrs$
            $\land p \in recv[m]$            $p$ has received $m$
            $\land sent' = [sent \text{ EXCEPT } ![m] = @ \cup \{q\}]$
            $\land \text{UNCHANGED } \langle recv \rangle$

$Next \triangleq$
        $\exists p \in Proc, q \in Proc, m \in Message :$
            $\lor Send(m, p)$
            $\lor Recv(m, p)$
            $\lor Forward(m, p, q)$

$Spec \triangleq Init \land \Box[Next]_{\langle sent, recv \rangle}$
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THEOREM $Spec \Rightarrow \Box TypeInvariant$

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* Modification History

* Last modified *Tue Mar* 07 19:40:05 *CET* 2023 by *kulpreet*

* Created Sun *Mar* 05 15:04:04 *CET* 2023 by *kulpreet*