MODULE *Network*

We need a separate network layer. In this layer, we formalize two features of *Nebulas* network:
1. message may be reordered,
2. message may be lost.

EXTENDS *Naturals*
CONSTANT *Message*
CONSTANT *endpoint*

VARIABLES *trans_buffer*, messages need to transfer
recv_buffer received messages

$NetworkTypeOK \triangleq \land trans\_buffer \in [endpoint \to \text{SUBSET } Message]$
$\land recv\_buffer \in [endpoint \to \text{SUBSET } Message]$

$NetworkInit \triangleq \land trans\_buffer = [v \in endpoint \mapsto \{\}]$
$\land recv\_buffer = [v \in endpoint \mapsto \{\}]$

$Send(target, msg) \triangleq$ put the message into *trans_buffer*
$\land trans\_buffer' = [trans\_buffer \text{ EXCEPT } ![target] = trans\_buffer[target] \cup \{msg\}]$
$\land \text{UNCHANGED } \langle endpoint, recv\_buffer \rangle$

$Broadcast(from, msg) \triangleq$
broadcast the *msg* to all enpoints, however, we won't make sure all of them recv the *msg*
$\forall p \in endpoint \setminus \{from\} : Send(p, msg)$

$Recv(target) \triangleq$ move the message from *trans_buffer* to *recv_buffer*, or just delete it
$\exists msg \in trans\_buffer[target] :$
$\lor \land recv\_buffer' = [recv\_buffer \text{ EXCEPT } ![target] = recv\_buffer[target] \cup \{msg\}]$
$\land trans\_buffer' = [trans\_buffer \text{ EXCEPT } ![target] = trans\_buffer[target] \setminus \{msg\}]$
$\lor \land trans\_buffer' = [trans\_buffer \text{ EXCEPT } ![target] = trans\_buffer[target] \setminus \{msg\}]$
$\land \text{UNCHANGED } \langle recv\_buffer \rangle$

$RecvedMsgs(e) \triangleq recv\_buffer[e]$

$RemoveMsg(e, msg) \triangleq \land recv\_buffer' = [recv\_buffer \text{ EXCEPT } ![e] = recv\_buffer[e] \setminus \{msg\}]$
$\land \text{UNCHANGED } \langle trans\_buffer \rangle$

$NetworkNext \triangleq \exists e \in endpoint : Recv(e)$

$NetworkSpec \triangleq NetworkInit \land \Box[NetworkNext]_{\langle trans\_buffer, recv\_buffer \rangle}$

THEOREM $NetworkSpec \Rightarrow \Box NetworkTypeOK$

* Modification History
* Last modified Sat *Feb* 03 16:20:39 *CST* 2018 by *xuepeng*

\ * Created Sat *Jan* 27 16:40:51 *CST* 2018 by *xuepeng*