MODULE *Southbound*

INSTANCE *Naturals*

INSTANCE *FiniteSets*

LOCAL INSTANCE *TLC*

An empty constant
CONSTANT *Nil*

Target is the set of all targets and their possible paths and values.

Example: $Target \triangleq$ [
values $\mapsto$ [
*path*1 $\mapsto$ {"*value*1", "*value*2"},
*path*2 $\mapsto$ {"*value*3"}]
CONSTANT *Target*

A record of target states
VARIABLE *target*

The set of all nodes
CONSTANT *Node*

The state of nodes
VARIABLE *node*

This section models node and target states.

$$
\begin{aligned}
&Start \triangleq \\
&\quad \land \neg target.running \\
&\quad \land target' = [target \text{ EXCEPT } !.incarnation = target.incarnation + 1, \\
&\qquad\qquad\qquad\qquad\quad !.running \quad\;\; = \text{TRUE}] \\
&\quad \land \text{UNCHANGED } \langle node \rangle
\end{aligned}
$$

$$
\begin{aligned}
&Stop \triangleq \\
&\quad \land target.running \\
&\quad \land target' = [target \text{ EXCEPT } !.running \;\; = \text{FALSE}, \\
&\qquad\qquad\qquad\qquad\quad !.values = [p \in \{\} \mapsto [value \mapsto Nil]]] \\
&\quad \land \text{UNCHANGED } \langle node \rangle
\end{aligned}
$$

$$
\begin{aligned}
&Connect(n) \triangleq \\
&\quad \land \neg node[n].connected \\
&\quad \land target.running \\
&\quad \land node' = [node \text{ EXCEPT } ![n].incarnation = node[n].incarnation + 1, \\
&\qquad\qquad\qquad\qquad\quad ![n].connected \quad = \text{TRUE}]
\end{aligned}
$$

$\land$ UNCHANGED $\langle target \rangle$

$Disconnect(n) \triangleq$
$\land\ node[n].connected$
$\land\ node' = [node \text{ EXCEPT } ![n].connected = \text{FALSE}]$
$\land$ UNCHANGED $\langle target \rangle$

$InitSouthbound \triangleq$
$\land\ target = [incarnation \mapsto 0,$
$\quad running \mapsto \text{FALSE},$
$\quad values \mapsto [p \in \{\} \mapsto [value \mapsto Nil]]]$
$\land\ node = [n \in Node \mapsto [incarnation \mapsto 0,\ connected \mapsto \text{FALSE}]]$

$NextSouthbound \triangleq$
$\lor\ Start$
$\lor\ Stop$
$\lor \exists\, n \in Node : Connect(n)$
$\lor \exists\, n \in Node : Disconnect(n)$

ASSUME $\land \forall\, p \in \text{DOMAIN } Target.values :$
$\quad IsFiniteSet(Target.values[p])$

ASSUME $\land\ IsFiniteSet(Node)$
$\quad \land \forall\, n \in Node :$
$\quad\quad \land\ n \in \text{STRING}$

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* Modification History
* Last modified Sun *Feb* 20 09:09:52 *PST* 2022 by *jordanhalterman*
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