MODULE *Southbound*

INSTANCE *Naturals*

INSTANCE *FiniteSets*

LOCAL INSTANCE *TLC*

An empty constant
CONSTANT *Nil*

A record of target states
VARIABLE *target*

The set of all nodes
CONSTANT *Nodes*

The state of nodes
VARIABLE *node*

This section models node and target states.

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

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

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

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

$$
\begin{array}{l}
\textit{InitSouthbound} \triangleq \\
\quad \land\ \textit{target} = [\textit{incarnation} \mapsto 0, \\
\qquad\qquad \textit{running} \quad \mapsto \text{FALSE}, \\
\qquad\qquad \textit{values} \quad\ \mapsto [p \in \{\} \mapsto [\textit{value} \mapsto \textit{Nil}]]] \\
\quad \land\ \textit{node} = [n \in \textit{Nodes} \mapsto [\textit{incarnation} \mapsto 0,\ \textit{connected} \mapsto \text{FALSE}]]
\end{array}
$$

$$
\begin{array}{l}
\textit{NextSouthbound} \triangleq \\
\quad \lor\ \textit{Start} \\
\quad \lor\ \textit{Stop} \\
\quad \lor\ \exists\, n \in \textit{Nodes} : \textit{Connect}(n) \\
\quad \lor\ \exists\, n \in \textit{Nodes} : \textit{Disconnect}(n)
\end{array}
$$

$$
\begin{array}{ll}
\text{ASSUME} & \land\ \textit{IsFiniteSet}(\textit{Nodes}) \\
& \land\ \forall\, n \in \textit{Nodes} : \\
& \qquad \land\ n \in \text{STRING}
\end{array}
$$

* Modification History
* Last modified Sun *Feb* 20 09:09:52 *PST* 2022 by *jordanhalterman*
* Created Sun *Feb* 20 03:13:26 *PST* 2022 by *jordanhalterman*