MODULE *Northbound*

EXTENDS *Proposal*

INSTANCE *Naturals*

INSTANCE *FiniteSets*

INSTANCE *Sequences*

LOCAL INSTANCE *TLC*

This section models configuration changes and rollbacks. Changes are appended to the proposal log and processed asynchronously.

$$
\begin{array}{l}
Value(s,\ p) \triangleq \\
\quad \text{LET } value \triangleq \text{CHOOSE } v \in s : v.path = p \\
\quad \text{IN} \\
\qquad [value \mapsto value.value, \\
\qquad\ delete \mapsto value.delete, \\
\qquad\ valid \mapsto value.valid]
\end{array}
$$

$$
\begin{array}{l}
Paths(s) \triangleq \\
\quad [p \in \{v.path : v \in s\} \mapsto Value(s,\ p)]
\end{array}
$$

$$
\begin{array}{l}
ValidValues(p) \triangleq \\
\quad \text{UNION } \{\{[value \mapsto v,\ delete \mapsto \text{FALSE},\ valid \mapsto \text{TRUE}] : v \in Target.values[p]\}, \\
\qquad\qquad \{[value \mapsto v,\ delete \mapsto \text{FALSE},\ valid \mapsto \text{FALSE}] : v \in Target.values[p]\}, \\
\qquad\qquad \{[value \mapsto Nil,\ delete \mapsto \text{TRUE},\ valid \mapsto \text{TRUE}]\}, \\
\qquad\qquad \{[value \mapsto Nil,\ delete \mapsto \text{TRUE},\ valid \mapsto \text{FALSE}]\}\}
\end{array}
$$

$$
\begin{array}{l}
ValidPaths \triangleq \\
\quad \text{UNION } \{\{v \mathbin{@@} [path \mapsto p] : v \in ValidValues(p)\} : p \in \text{DOMAIN } Target.values\}
\end{array}
$$

The set of all valid sets of changes to all targets and their paths.

The set of possible changes is computed from the *Target* model value.

$$
\begin{array}{l}
ValidChanges \triangleq \\
\quad \text{LET } changeSets \triangleq \{s \in \text{SUBSET } ValidPaths : \\
\qquad\qquad\qquad\qquad \land \forall\, p \in \text{DOMAIN } Target.values : \\
\qquad\qquad\qquad\qquad\quad \land\ Cardinality(\{v \in s : v.path = p\}) \leq 1\} \\
\quad \text{IN} \\
\qquad \{c \in \{Paths(s) : s \in changeSets\} : \text{DOMAIN } c \neq \{\}\}
\end{array}
$$

Add change 'c' to the proposal log

$$
\begin{array}{l}
Change(c) \triangleq \\
\quad \land \quad \text{LET } index \triangleq Len(proposal) + 1 \\
\qquad\ \ \text{IN} \quad proposal' = proposal \mathbin{@@} \\
\qquad\qquad\qquad (index :> [type \mapsto ProposalChange,
\end{array}
$$

$$
\begin{array}{ll}
\textit{change} & \mapsto [\textit{values} \mapsto c], \\
\textit{rollback} & \mapsto [\textit{index} \mapsto 0], \\
\textit{phase} & \mapsto \textit{ProposalCommit}, \\
\textit{state} & \mapsto \textit{ProposalInProgress}])
\end{array}
$$

$\land$ UNCHANGED $\langle \textit{configuration}, \textit{mastership}, \textit{node}, \textit{target} \rangle$

Add a rollback of proposal 'i' to the proposal log

$\textit{Rollback}(i) \triangleq$

$\land$ LET $\textit{index} \triangleq \textit{Len}(\textit{proposal}) + 1$

IN $\textit{proposal}' = \textit{proposal} \mathbin{@@}$

$$
\begin{array}{ll}
(\textit{index} :> [\textit{type} & \mapsto \textit{ProposalRollback}, \\
\textit{change} & \mapsto [\textit{index} \mapsto 0], \\
\textit{rollback} & \mapsto [\textit{index} \mapsto i], \\
\textit{phase} & \mapsto \textit{ProposalCommit}, \\
\textit{state} & \mapsto \textit{ProposalInProgress}])
\end{array}
$$

$\land$ UNCHANGED $\langle \textit{configuration}, \textit{mastership}, \textit{node}, \textit{target} \rangle$

Formal specification, constraints, and theorems.

$\textit{InitNorthbound} \triangleq$ TRUE

$\textit{NextNorthbound} \triangleq$

$\lor \exists\, c \in \textit{ValidChanges} :$
  $\textit{Change}(c)$

$\lor \exists\, i \in$ DOMAIN $\textit{proposal} :$
  $\textit{Rollback}(i)$

---

* Modification History
* Last modified *Fri Apr* 21 16:42:15 *PDT* 2023 by *jhalterm*
* Last modified Sun *Feb* 20 10:10:06 *PST* 2022 by *jordanhalterman*
* Created Sun *Feb* 20 03:08:25 *PST* 2022 by *jordanhalterman*