MODULE *MapHistory*

EXTENDS *Naturals*, *FiniteSets*, *Sequences*, *TLC*

The history of history for the client, used by the model checker to verify sequential consistency
VARIABLE *history*

The history of events received by the client, used by the model checker to verify sequential consistency
VARIABLE *events*

The state invariant checks that the client's history never go back in time

$$
\begin{array}{l}
\mathit{StateInvariant} \triangleq \\
\quad \land \forall\, c \in \text{DOMAIN } \mathit{history} : \\
\qquad \land \forall\, k \in \text{DOMAIN } \mathit{history}[c] : \\
\qquad\quad \land \forall\, r \in \text{DOMAIN } \mathit{history}[c][k] : \\
\qquad\qquad r > 1 \Rightarrow \mathit{history}[c][k][r] \geq \mathit{history}[c][k][r-1]
\end{array}
$$

The events invariant checks that events are sequential

$$
\begin{array}{l}
\mathit{EventInvariant} \triangleq \\
\quad \land \forall\, c \in \text{DOMAIN } \mathit{events} : \\
\qquad \land \forall\, k \in \text{DOMAIN } \mathit{events}[c] : \\
\qquad\quad \land \forall\, r \in \text{DOMAIN } \mathit{events}[c][k] : \\
\qquad\qquad r > 1 \Rightarrow \mathit{events}[c][k][r] > \mathit{events}[c][k][r-1]
\end{array}
$$

Record a read to the history

$$
\begin{array}{l}
\mathit{RecordRead}(c,\, k,\, v) \triangleq \\
\quad \land \lor \land c \in \text{DOMAIN } \mathit{history} \\
\qquad\quad \land k \in \text{DOMAIN } \mathit{history}[c] \\
\qquad\quad \land \mathit{history}' = [\mathit{history} \text{ EXCEPT } ![c][k] = \mathit{Append}(\mathit{history}[c][k],\, v)] \\
\qquad \lor \land c \in \text{DOMAIN } \mathit{history} \\
\qquad\quad \land k \notin \text{DOMAIN } \mathit{history}[c] \\
\qquad\quad \land \mathit{history}' = [\mathit{history} \text{ EXCEPT } ![c] = \mathit{history}[c] \mathbin{@@} (k :> \langle v \rangle)] \\
\qquad \lor \land c \notin \text{DOMAIN } \mathit{history} \\
\qquad\quad \land \mathit{history}' = \mathit{history} \mathbin{@@} (c :> [i \in \{k\} \mapsto \langle v \rangle])
\end{array}
$$

Record an event to the history

$$
\begin{array}{l}
\mathit{RecordEvent}(c,\, k,\, v) \triangleq \\
\quad \land \lor \land c \in \text{DOMAIN } \mathit{events} \\
\qquad\quad \land k \in \text{DOMAIN } \mathit{events}[c] \\
\qquad\quad \land \mathit{events}' = [\mathit{events} \text{ EXCEPT } ![c][k] = \mathit{Append}(\mathit{events}[c][k],\, v)] \\
\qquad \lor \land c \in \text{DOMAIN } \mathit{events} \\
\qquad\quad \land k \notin \text{DOMAIN } \mathit{events}[c] \\
\qquad\quad \land \mathit{events}' = [\mathit{events} \text{ EXCEPT } ![c] = \mathit{events}[c] \mathbin{@@} (k :> \langle v \rangle)] \\
\qquad \lor \land c \notin \text{DOMAIN } \mathit{events} \\
\qquad\quad \land \mathit{events}' = \mathit{events} \mathbin{@@} (c :> [i \in \{k\} \mapsto \langle v \rangle])
\end{array}
$$

\ * Modification History
\ * Last modified Sun *Feb* 16 19:11:53 *PST* 2020 by *jordanhalterman*
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