MODULE *Client_Server*

EXTENDS *Server*, *Client*
VARIABLE *locked*, *held*

$$
\begin{aligned}
&\mathit{Init} \triangleq \\
&\quad \land\, \mathit{locked} = [i \in \mathit{Server} \mapsto \text{TRUE}] \\
&\quad \land\, \mathit{held} = [i \in \mathit{Client} \mapsto \{\}]
\end{aligned}
$$

$$
\begin{aligned}
&\mathit{Connect}(\mathit{client}, \mathit{server}) \triangleq \\
&\quad \land \quad \mathit{locked}[\mathit{server}] = \text{TRUE} \\
&\quad \land \quad \mathit{held}' = [\mathit{held} \text{ EXCEPT } ![\mathit{client}] = \mathit{held}[\mathit{client}] \cup \{\mathit{server}\}] \\
&\quad \land \quad \mathit{locked}' = [\mathit{locked} \text{ EXCEPT } ![\mathit{server}] = \text{FALSE}]
\end{aligned}
$$

$$
\begin{aligned}
&\mathit{Disconnect}(\mathit{client}, \mathit{server}) \triangleq \\
&\quad \land\, \mathit{server} \in \mathit{held}[\mathit{client}] \\
&\quad \land\, \mathit{held}' = [\mathit{held} \text{ EXCEPT } ![\mathit{client}] = \mathit{held}[\mathit{client}] \setminus \{\mathit{server}\}] \\
&\quad \land\, \mathit{locked}' = [\mathit{locked} \text{ EXCEPT } ![\mathit{server}] = \text{TRUE}]
\end{aligned}
$$

$$
\begin{aligned}
&\mathit{Next} \triangleq \\
&\quad \lor\, \exists\, \mathit{client} \in \mathit{Client}, \mathit{server} \in \mathit{Server} : \mathit{Connect}(\mathit{client}, \mathit{server}) \\
&\quad \lor\, \exists\, \mathit{client} \in \mathit{Client}, \mathit{server} \in \mathit{Server} : \mathit{Disconnect}(\mathit{client}, \mathit{server})
\end{aligned}
$$

$$\mathit{Spec} \triangleq \mathit{Init} \land \Box[\mathit{Next}]_{\langle \mathit{locked}, \mathit{held} \rangle}$$

$$
\begin{aligned}
&\mathit{Safe} \triangleq \\
&\quad \forall\, \mathit{client\_i}, \mathit{client\_j} \in \mathit{Client} : \\
&\quad (\mathit{held}[\mathit{client\_i}] \cap \mathit{held}[\mathit{client\_j}] \neq \{\}) \lor (\mathit{client\_i} = \mathit{client\_j})
\end{aligned}
$$