MODULE *AsyncInterface*

EXTENDS *Naturals*
CONSTANT *Data*
VARIABLES *val*, *rdy*, *ack*

We first define the type invariant. ie., the invariant that should be satisfied by the spec at all times and that defines what the legal values can be for the variables in the *Spec*. Here we define *val* to be some value in the set *Data*, *rdy* and *ack* can be either 0 or 1. It cannot have any other value.

$$\begin{aligned} \mathit{TypeInvariant} \triangleq\ & \land (\mathit{val} \in \mathit{Data}) \\ & \land (\mathit{rdy} \in \{0, 1\}) \\ & \land (\mathit{ack} \in \{0, 1\}) \end{aligned}$$

Initially, *val* can be any *Data*, *rdy* and *ack* are the same value and can be either 0 or 1.

$$\begin{aligned} \mathit{Init} \triangleq\ & \land (\mathit{val} \in \mathit{Data}) \\ & \land (\mathit{rdy} \in \{0, 1\}) \\ & \land (\mathit{ack} = \mathit{rdy}) \end{aligned}$$

We can either send or receive data in the next step

$$\mathit{Next} \triangleq \mathit{Send} \lor \mathit{Recv}$$

Send $\rightarrow$ For send to happen, initially *rdy* and *ack* should be the same. The next state of *rdy* should change to !*rdy* and *ack* should remain the same Ofcourse, *val* is now the data that we want to send and it will be something from set *Data*

$$\begin{aligned} \mathit{Send} \triangleq\ & \land \mathit{rdy} = \mathit{ack} \\ & \land \mathit{val}' \in \mathit{Data} \\ & \land \mathit{rdy}' = 1 - \mathit{rdy} \\ & \land \text{UNCHANGED } \mathit{ack} \end{aligned}$$

$$\begin{aligned} \mathit{Recv} \triangleq\ & \land \mathit{rdy} \neq \mathit{ack} \\ & \land \mathit{ack}' = 1 - \mathit{ack} \\ & \land \text{UNCHANGED } \langle \mathit{val}, \mathit{rdy} \rangle \end{aligned}$$

$$\mathit{Next} \triangleq \mathit{Send} \lor \mathit{Recv}$$

$$\mathit{Spec} \triangleq \mathit{Init} \land [\mathit{Next}]_{\langle \mathit{val}, \mathit{ack}, \mathit{rdy} \rangle}$$

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