
MODULE *TCommit*

CONSTANT *RM* The set of all Resource Managers (*e.g.* {“*r1*”, “*r2*”, “*r3*”})
 VARIABLE *rmState* *rmState*[*rm*] is the state of the Resource Manager *rm*

$TCTypeOK \triangleq rmState \in [RM \rightarrow \{\text{“working”}, \text{“prepared”}, \text{“committed”}, \text{“aborted”}\}]$
 $TCTInit \triangleq rmState = [r \in RM \mapsto \text{“working”}]$

$Prepare(r) \triangleq \begin{aligned} &\wedge rmState[r] = \text{“working”} \\ &\wedge rmState' = [rmState \text{ EXCEPT } ![r] = \text{“prepared”}] \\ &\quad [s \in RM \mapsto \text{IF } s = r \text{ THEN “prepared” ELSE } rmState[s]] \end{aligned}$

$canCommit \triangleq \forall r \in RM : rmState[r] \in \{\text{“prepared”}, \text{“comitted”}\}$
 $notCommitted \triangleq \forall r \in RM : rmState[r] \neq \text{“committed”}$

$DecideToCommit(r) \triangleq \begin{aligned} &\wedge rmState[r] = \text{“prepared”} \\ &\wedge canCommit \\ &\wedge rmState' = [rmState \text{ EXCEPT } ![r] = \text{“committed”}] \end{aligned}$

$DecideToAbort(r) \triangleq \begin{aligned} &\wedge rmState[r] \in \{\text{“working”}, \text{“prepared”}\} \\ &\wedge notCommitted \\ &\wedge rmState' = [rmState \text{ EXCEPT } ![r] = \text{“aborted”}] \end{aligned}$

$Decide(r) \triangleq \begin{aligned} &\vee DecideToCommit(r) \\ &\vee DecideToAbort(r) \end{aligned}$

$TCNext \triangleq \exists r \in RM : Prepare(r) \vee Decide(r)$

$TCConsistent \triangleq \forall r1, r2 \in RM : \neg \wedge rmState[r1] = \text{“aborted”} \\ \wedge rmState[r2] = \text{“committed”}$

$TCSpec \triangleq TCTInit \wedge \Box [TCNext]_{rmState}$

THEOREM $TCSpec \Rightarrow \Box (TCTypeOK \wedge TCConsistent)$

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