

Flattened formal specification produced by Meeduse from the PNML meta-model

- 420 LOC
- 34 modeling operations
- 96 POs (89 aut, 7 int)

MACHINE

ptnets / pnmlcoremodel + pntd*/*

SETS

ID_AS;
LABEL_

ABSTRACT_VARIABLES

ID,
Label,
Object,
PTMarking,
PTArcAnnotation,
Node,
Arc,
PlaceNode,
TransitionNode,
Place,
Transition,
source,
target,
initialMarking,
inscription,
PTMarking_text,
PTArcAnnotation_text

INVARIANT

$ID \in \mathcal{F} (ID_AS) \wedge$
 $Label \in \mathcal{F} (LABEL_)$
 $Object \subseteq ID \wedge$
 $PTMarking \subseteq Label \wedge$
 $PTArcAnnotation \subseteq Label \wedge$
 $Node \subseteq Object \wedge$
 $Arc \subseteq Object \wedge$
 $PlaceNode \subseteq Node \wedge$

$TransitionNode \subseteq Node \wedge$
 $Place \subseteq PlaceNode \wedge$
 $Transition \subseteq TransitionNode \wedge$
 $source \in Arc \rightarrow Node \wedge$
 $target \in Arc \rightarrow Node \wedge$
 $initialMarking \in Place \leftrightarrow PTMarking \wedge$
 $inscription \in Arc \leftrightarrow PTArcAnnotation \wedge$
 $PTMarking_text \in PTMarking \rightarrow \mathbf{NAT} \wedge$
 $PTArcAnnotation_text \in PTArcAnnotation \rightarrow \mathbf{NAT1} \wedge$
 $PTArcAnnotation \cap PTMarking = \emptyset \wedge$
 $Node \cap Arc = \emptyset \wedge$
 $PlaceNode \cap TransitionNode = \emptyset$

INITIALISATION

$ID := \emptyset \parallel$
 $Label := \emptyset \parallel$
 $Object := \emptyset \parallel$
 $PTMarking := \emptyset \parallel$
 $PTArcAnnotation := \emptyset \parallel$
 $Node := \emptyset \parallel$
 $PlaceNode := \emptyset \parallel$
 $TransitionNode := \emptyset \parallel$
 $Arc := \emptyset \parallel$
 $Place := \emptyset \parallel$
 $Transition := \emptyset \parallel$
 $source := \emptyset \parallel$
 $target := \emptyset \parallel$
 $initialMarking := \emptyset \parallel$
 $inscription := \emptyset \parallel$
 $PTMarking_text := \emptyset \parallel$
 $PTArcAnnotation_text := \emptyset$

OPERATIONS

PTMarking_NEW($aPTMarking$) =
PRE $aPTMarking \in LABEL_ \wedge$
 $aPTMarking \notin Label$

THEN

$PTMarking := PTMarking \cup \{aPTMarking\} \parallel$
 $Label := Label \cup \{aPTMarking\} \parallel$
 $PTMarking_text := PTMarking_text \cup \{(aPTMarking \mapsto 0)\}$

END;

PTArcAnnotation_NEW($aPTArcAnnotation$) =
PRE $aPTArcAnnotation \in LABEL_ \wedge$
 $aPTArcAnnotation \notin Label$

THEN

$PTArcAnnotation := PTArcAnnotation \cup \{aPTArcAnnotation\} \parallel$
 $Label := Label \cup \{aPTArcAnnotation\} \parallel$
 $PTArcAnnotation_text := PTArcAnnotation_text \cup \{(aPTArcAnnotation \mapsto 1)\}$

END;

Arc_NEW($aArc, aSource, aTarget$) =

PRE $aArc \in ID_AS \wedge$
 $aSource \in Node \wedge$
 $aTarget \in Node \wedge$
 $aArc \notin ID$

THEN

$Arc := Arc \cup \{aArc\} \parallel$
 $ID := ID \cup \{aArc\} \parallel$
 $Object := Object \cup \{aArc\} \parallel$
 $source := source \cup \{(aArc \mapsto aSource)\} \parallel$
 $target := target \cup \{(aArc \mapsto aTarget)\}$

END;

Place_NEW($aPlace$) =

PRE $aPlace \in ID_AS \wedge$
 $aPlace \notin ID$
 $\wedge aPlace \notin TransitionNode$

THEN

$PlaceNode := PlaceNode \cup \{aPlace\} \parallel$
 $Node := Node \cup \{aPlace\} \parallel$
 $ID := ID \cup \{aPlace\} \parallel$
 $Place := Place \cup \{aPlace\} \parallel$
 $Object := Object \cup \{aPlace\}$

END;

PTMarking_Free($aPTMarking$) =

PRE $aPTMarking \in PTMarking$

THEN

$PTMarking := PTMarking - \{aPTMarking\} \parallel$
 $Label := Label - \{aPTMarking\} \parallel$
 $initialMarking := initialMarking \ominus \{aPTMarking\} \parallel$
 $PTMarking_text := \{aPTMarking\} \triangleleft PTMarking_text$

END;

PTArcAnnotation_Free($aPTArcAnnotation$) =

PRE $aPTArcAnnotation \in PTArcAnnotation$

THEN

$PTArcAnnotation := PTArcAnnotation - \{aPTArcAnnotation\} \parallel$
 $Label := Label - \{aPTArcAnnotation\} \parallel$
 $inscription := inscription \ominus \{aPTArcAnnotation\} \parallel$
 $PTArcAnnotation_text := \{aPTArcAnnotation\} \triangleleft PTArcAnnotation_text$

END;

Arc_Free($aArc$) =

PRE $aArc \in Arc$

THEN

$Arc := Arc - \{aArc\} \parallel$
 $ID := ID - \{aArc\} \parallel$
 $Object := Object - \{aArc\} \parallel$
 $source := \{aArc\} \triangleleft source \parallel$
 $target := \{aArc\} \triangleleft target \parallel$
 $inscription := \{aArc\} \triangleleft inscription$

END;

Place_Free($aPlace$) =

PRE $aPlace \in Place \wedge$
 $source^{-1} [\{aPlace\}] = \emptyset \wedge$
 $target^{-1} [\{aPlace\}] = \emptyset$

THEN

$PlaceNode := PlaceNode - \{aPlace\} \parallel$
 $Node := Node - \{aPlace\} \parallel$
 $ID := ID - \{aPlace\} \parallel$
 $Place := Place - \{aPlace\} \parallel$
 $Object := Object - \{aPlace\} \parallel$
 $source := source \triangleright \{aPlace\} \parallel$
 $target := target \triangleright \{aPlace\} \parallel$
 $initialMarking := \{aPlace\} \triangleleft initialMarking$

END;

$result \leftarrow \mathbf{Node_GetOut}(aNode) =$

PRE $aNode \in Node \wedge$
 $aNode \in \mathbf{ran}(source)$

THEN

$result := source^{-1} [\{aNode\}]$

END;

$result \leftarrow \mathbf{Node_GetIn}(aNode) =$

PRE $aNode \in Node \wedge$
 $aNode \in \mathbf{ran}(target)$

THEN

$result := target^{-1} [\{aNode\}]$

END;

$result \leftarrow \mathbf{Arc_GetSource}(aArc) =$

PRE $aArc \in Arc \wedge$
 $aArc \in \mathbf{dom}(source)$

THEN

$result := source(aArc)$

END;

$result \leftarrow \mathbf{Arc_GetTarget}(aArc) =$

PRE $aArc \in Arc \wedge$
 $aArc \in \mathbf{dom}(target)$

THEN
 $result := target(aArc)$
END;

$result \leftarrow \mathbf{Place_GetInitialMarking}(aPlace) =$
PRE $aPlace \in Place \wedge$
 $aPlace \in \mathbf{dom}(initialMarking)$

THEN
 $result := initialMarking(aPlace)$
END;

$result \leftarrow \mathbf{Arc_GetInscription}(aArc) =$
PRE $aArc \in Arc \wedge$
 $aArc \in \mathbf{dom}(inscription)$

THEN
 $result := inscription(aArc)$
END;

$\mathbf{Node_SetOut}(aNode, theOut) =$
PRE $aNode \in Node \wedge$
 $theOut \in \mathcal{F}(Arc) \wedge$
 $(theOut \times \{aNode\}) \not\subseteq source \wedge$
 $source^{-1}[\{aNode\}] = \emptyset \wedge$
 $\forall added. (added \in theOut \Rightarrow source[\{added\}] = \emptyset)$

THEN
 $source := (source \triangleright \{aNode\}) \cup (theOut \times \{aNode\})$
END;

$\mathbf{Node_SetIn}(aNode, theIn) =$
PRE $aNode \in Node \wedge$
 $theIn \in \mathcal{F}(Arc) \wedge$
 $(theIn \times \{aNode\}) \not\subseteq target \wedge$
 $target^{-1}[\{aNode\}] = \emptyset \wedge$
 $\forall added. (added \in theIn \Rightarrow target[\{added\}] = \emptyset)$

THEN
 $target := (target \triangleright \{aNode\}) \cup (theIn \times \{aNode\})$
END;

$\mathbf{Arc_SetSource}(aArc, aSource) =$
PRE $aArc \in Arc \wedge$
 $aSource \in Node \wedge$
 $\{(aArc \mapsto aSource)\} \not\subseteq source$

THEN
 $source := (\{aArc\} \triangleleft source) \cup \{(aArc \mapsto aSource)\}$
END;

$\mathbf{Arc_SetTarget}(aArc, aTarget) =$
PRE $aArc \in Arc \wedge$
 $aTarget \in Node \wedge$

$\{(aArc \mapsto aTarget)\} \not\subseteq target$

THEN

$target := (\{aArc\} \triangleleft target) \cup \{(aArc \mapsto aTarget)\}$

END;

Place_SetInitialMarking($aPlace, aInitialMarking$) =

PRE $aPlace \in Place \wedge$

$aInitialMarking \in PTMarking \wedge$

$\{(aPlace \mapsto aInitialMarking)\} \not\subseteq initialMarking \wedge$

$initialMarking^{-1} [\{aInitialMarking\}] = \emptyset$

THEN

$initialMarking := (\{aPlace\} \triangleleft initialMarking) \cup \{(aPlace \mapsto aInitialMarking)\}$

END;

Arc_SetInscription($aArc, aInscription$) =

PRE $aArc \in Arc \wedge$

$aInscription \in PTArcAnnotation \wedge$

$\{(aArc \mapsto aInscription)\} \not\subseteq inscription \wedge$

$inscription^{-1} [\{aInscription\}] = \emptyset$

THEN

$inscription := (\{aArc\} \triangleleft inscription) \cup \{(aArc \mapsto aInscription)\}$

END;

Node_UnsetOut($aNode$) =

PRE $aNode \in Node \wedge$

$source^{-1} [\{aNode\}] = \emptyset$

THEN

$source := source \triangleright \{aNode\}$

END;

Node_UnsetIn($aNode$) =

PRE $aNode \in Node \wedge$

$target^{-1} [\{aNode\}] = \emptyset$

THEN

$target := target \triangleright \{aNode\}$

END;

Place_UnsetInitialMarking($aPlace$) =

PRE $aPlace \in Place$

THEN

$initialMarking := \{aPlace\} \triangleleft initialMarking$

END;

Arc_UnsetInscription($aArc$) =

PRE $aArc \in Arc$

THEN

$inscription := \{aArc\} \triangleleft inscription$

END;

Node_AddOut($aNode, aOut$) =

PRE $aNode \in Node \wedge$
 $aOut \in Arc \wedge$
 $(aOut \mapsto aNode) \notin source \wedge$
 $source[\{aOut\}] = \emptyset$

THEN

$source := source \cup \{(aOut \mapsto aNode)\}$

END;

Node_AddIn($aNode, aIn$) =

PRE $aNode \in Node \wedge$
 $aIn \in Arc \wedge$
 $(aIn \mapsto aNode) \notin target \wedge$
 $target[\{aIn\}] = \emptyset$

THEN

$target := target \cup \{(aIn \mapsto aNode)\}$

END;

Node_RemoveOut($aNode, aOut$) =

PRE $aNode \in Node \wedge$
 $aOut \in Arc \wedge$
 $(aOut \mapsto aNode) \in source \wedge$
 $\mathbf{card}(source[\{aOut\}]) \geq 2 \wedge$
 $source - \{aOut \mapsto aNode\} \in Arc \rightarrow Node$

THEN

$source := source - \{(aOut \mapsto aNode)\}$

END;

Node_RemoveIn($aNode, aIn$) =

PRE $aNode \in Node \wedge$
 $aIn \in Arc \wedge$
 $(aIn \mapsto aNode) \in target \wedge$
 $\mathbf{card}(target[\{aIn\}]) \geq 2$
 $\wedge target - \{aIn \mapsto aNode\} \in Arc \rightarrow Node$

THEN

$target := target - \{(aIn \mapsto aNode)\}$

END;

Place_RemoveInitialMarking($aPlace, aInitialMarking$) =

PRE $aPlace \in Place \wedge$
 $aInitialMarking \in PTMarking \wedge$
 $(aPlace \mapsto aInitialMarking) \in initialMarking$

THEN

$initialMarking := initialMarking - \{(aPlace \mapsto aInitialMarking)\}$

END;

Arc_RemoveInscription($aArc, aInscription$) =

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PRE    $aArc \in Arc \wedge$ 
          $aInscription \in PTArcAnnotation \wedge$ 
          $(aArc \mapsto aInscription) \in inscription$ 

THEN
    $inscription := inscription - \{(aArc \mapsto aInscription)\}$ 
END;

 $result \leftarrow \mathbf{PTMarking\_GetText}(aPTMarking) =$ 
PRE    $aPTMarking \in PTMarking \wedge$ 
          $aPTMarking \in \mathbf{dom}(PTMarking\_text)$ 

THEN
    $result := PTMarking\_text(aPTMarking)$ 
END;

 $result \leftarrow \mathbf{PTArcAnnotation\_GetText}(aPTArcAnnotation) =$ 
PRE    $aPTArcAnnotation \in PTArcAnnotation \wedge$ 
          $aPTArcAnnotation \in \mathbf{dom}(PTArcAnnotation\_text)$ 

THEN
    $result := PTArcAnnotation\_text(aPTArcAnnotation)$ 
END;

 $\mathbf{PTMarking\_SetText}(aPTMarking, aText) =$ 
PRE    $aPTMarking \in PTMarking \wedge$ 
          $aText \in \mathbf{NAT}$ 

THEN
    $PTMarking\_text := (\{aPTMarking\} \triangleleft PTMarking\_text) \cup \{(aPTMarking \mapsto aText)\}$ 
END;

 $\mathbf{PTArcAnnotation\_SetText}(aPTArcAnnotation, aText) =$ 
PRE    $aPTArcAnnotation \in PTArcAnnotation \wedge$ 
          $aText \in \mathbf{NAT1}$ 

THEN
    $PTArcAnnotation\_text := (\{aPTArcAnnotation\} \triangleleft PTArcAnnotation\_text) \cup$ 
    $\{(aPTArcAnnotation \mapsto aText)\}$ 
END

END

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