$[METHOD, ID, STATE]$

$$
\begin{array}{|l}
CALL : \mathbb{P}\, METHOD \\
RETURN : \mathbb{P}\, METHOD \\
nullmethod : METHOD \\
\hline
nullmethod \in RETURN \\
nullmethod \in CALL \\
CALL \bigcup RETURN = METHOD \\
CALL \bigcap RETURN = \{nullmethod\} \\
\#CALL = \#RETURN
\end{array}
$$

$PORT ::= send \mid receive \mid returned \mid return$
$CONTROL ::= ready \mid receive\_callin \mid running\_callin \mid$
$make\_callout \mid taked\_callout \mid receive\_return\_callout \mid$
$taked\_return\_callout \mid send\_return\_callin$

Layer

$$
\begin{array}{|l}
id : ID \\
export : CALL \\
import : ID \times CALL \\
states : \mathbb{P}\, STATE \\
start : STATE \\
compute : STATE \leftrightarrow ID \times STATE \times METHOD \\
runmethod : ID \times STATE \times CALL \leftrightarrow STATE \\
nextreturn : ID \times STATE \times RETURN \leftrightarrow STATE \\
\hline
start \in states \\
\forall\, m : CALL,\ i : ID\ s_1, s_2 : STATE \mid (s_1, (i, s_2, m)) \in compute \bullet \\
\qquad \{s_1, s_2\} \subset states \land \exists\, i : ID (i, m) \in import \\
\forall\, i : ID,\ s_1, s_2 : STATE,\ c : CALL \mid ((i, s_1, c), s_2) \in runmethod \bullet \\
\qquad \{s_1, s_2\} \subset states \land \exists\, i : ID \bullet (i, c) \in import \\
\forall\, i : ID,\ s_1, s_2 : STATE,\ r : RETURN \mid ((i, s_1, r), s_2) \in nextreturn \bullet \\
\qquad \{s_1, s_2\} \subset states \land \exists\, i : ID \bullet (c, returnby?\, r) \in import
\end{array}
$$

Layer_State

$$
\begin{array}{l}
l : Layer \\
current : STATE \\
in : ID \\
out : ID \\
port : PORT \times ID \nrightarrow METHOD \\
ctrl : CONTROL \\
\hline
current \in l.states \\
out \in \{ i : ID \mid \exists\, c : CALL \bullet (i, c) \in l.import \} \\
\forall\, p : PORT, i : ID \mid p \in \{send, receive\} \land (p, i) \in domain\ port \bullet \\
\qquad port\ p\ i \ \in CALL \\
\forall\, p : PORT, i : ID \mid p \in \{return, returned\} \land (p, i) \in domain\ port \bullet \\
\qquad port\ p\ i \ \in RETURN \\
\{ i : ID \mid (send, i) \in domain\ port \} = \{ i : ID \mid (returned, i) \in domain\ port \} \\
\{ i : ID \mid (receive, i) \in domain\ port \} = \{ i : ID \mid (return, i) \in domain\ port \} \\
FALTAPONERCOSASVERDESPUES!!
\end{array}
$$

Layer_InternalCompute

$$
\begin{array}{l}
\Delta Layer\_State \\
\hline
ctrl \in \{ready, running\_callin, taked\_return\_callout\} \\
l' = l \\
in' = in \\
out' = out \\
port' = port \\
ctrl' = ctrl \\
\exists\, s_1, s_2 : STATE, i : ID \mid (s_1, (i, s_2, nullmethod)) \in compute \bullet \\
\qquad current = s_1 \land current' = s_2
\end{array}
$$

$$
\begin{array}{l}
\textit{Layer\_MakeCallOut} \\
\hline
\Delta \textit{Layer\_State} \\
\hline
\textit{ctrl} \in \{\textit{running\_callin}, \textit{taked\_return\_callout}\} \\
l' = l \\
\textit{in}' = \textit{in} \\
\exists\, s_1, s_2 : \textit{STATE}, i : \textit{ID}, m : \textit{CALL} \mid (s_1, (i, s_2, m)) \in \textit{compute} \bullet \\
\qquad m \neq \textit{nullmethod} \\
\qquad \land\ \textit{current} = s_1 \\
\qquad \land\ \textit{current}' = s_2 \land \\
\qquad \land\ \textit{out}' = i \land \\
\qquad \land\ \textit{ctrl}' = \textit{make\_callout} \land \\
\qquad \land\ \textit{port}' \lhd \{(\textit{send}, i)\} = \textit{port} \lhd \{(\textit{send}, i)\} \land \\
\qquad \land\ \textit{port}'\ \textit{send}\ i = m \\
\hline
\end{array}
$$

$$
\begin{array}{l}
\textit{Layer\_TakeReturnCallOut} \\
\hline
\Delta \textit{Layer\_State} \\
\hline
\textit{ctrl} \in \{\textit{receive\_return\_callout}\} \\
l' = l \\
\textit{in}' = \textit{in} \\
\textit{out}' = \textit{out} \\
\textit{port}' = \textit{port} \\
\exists\, r : \textit{RETURN},\ s_1, s_2 : \textit{STATE} \mid ((\textit{out}, s_1, r), s_2) \in \textit{nextreturn} \bullet \\
\qquad \textit{current} = s1 \\
\qquad \land\ \textit{returnby?}\ r = \textit{port}\ \textit{send}\ \textit{out} \\
\qquad \land\ \textit{current}' = s_2 \\
\qquad \land\ \textit{ctrl}' = \textit{taked\_return\_callout} \\
\hline
\end{array}
$$

$$
\begin{array}{l}
\textit{Layer\_RunCallIn} \\
\hline
\Delta \textit{Layer\_State} \\
\hline
\textit{ctrl} \in \{\textit{receive\_callin}\} \\
l' = l \\
\textit{in}' = \textit{in} \\
\textit{out}' = \textit{out} \\
\textit{port}' = \textit{port} \\
\exists\, s_2 : \textit{STATE} \mid ((\textit{in}, \textit{current}, \textit{port}\ \textit{receive}\ \textit{in}), s_2) \in \textit{runmethod} \bullet \\
\qquad \textit{current}' = s_2 \\
\qquad \land\ \textit{ctrl}' = \textit{running\_callin} \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{Layer\_SendReturnCallIn} \\
\Delta \textit{Layer\_State} \\
\hline
\textit{ctrl} \in \{\textit{running\_callin}\} \\
\\
l' = l \\
\textit{in}' = \textit{in} \\
\textit{out}' = \textit{out} \\
\\
\exists\, s_1, s_2 : \textit{STATE}, r : \textit{RETURN} \mid (s_1, (\textit{in}, s_2, r)) \in \textit{compute} \bullet \\
\quad\quad \textit{current} = s_1 \\
\quad\quad \land\ r \neq \textit{nullmethod} \\
\quad\quad \land\ \textit{returnby?}\ r = \textit{port receive in} \\
\quad\quad \land\ \textit{current}' = \textit{s\_2} \\
\quad\quad \land\ \textit{port}' \lhd \{(\textit{return}, \textit{in})\} = \textit{port} \lhd \{(\textit{return}, \textit{in})\} \\
\quad\quad \land\ \textit{port}'\ \textit{return in} = r \\
\quad\quad \land\ \textit{ctrl}' = \textit{send\_return\_callin} \\
\hline
\end{array}
$$

$$
\begin{array}{l}
\textit{Layer\_Compute} \mathrel{\widehat{=}} \\
\quad \textit{Layer\_InternalCompute} \\
\quad \lor\ \textit{Layer\_MakeCallOut} \\
\quad \lor\ \textit{Layer\_TakeReturnCallOut} \\
\quad \lor\ \textit{Layer\_RunCallIn} \\
\quad \lor\ \textit{Layer\_SendReturnCallIn}
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{Connector} \\
\textit{Source}, \textit{Sink} : \textit{Layer} \\
\hline
\textit{Source.id} \neq \textit{Sink.id} \\
\textit{Source.import} \subset \textit{Sink.export} \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\textit{layername} : \mathbb{P}\, \textit{ID} \\
\textit{connectorname} : \mathbb{P}\, \textit{ID} \\
\hline
\textit{layername} \bigcap \textit{connectorname} = \emptyset
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{System} \\
\hline
syslayer : layername \rightarrow Layer \\
sysconnector : layername \times layername \rightarrow Connector \\
\hline
\forall\, c : connectorname \,\exists\, ln_1, ln_2 : layername \bullet \\
\qquad sysconnector\ c.Source = syslayer\ ln_1 \land \\
\qquad sysconnector\ c.Sink = syslayer\ ln_2 \\
\forall\, ln_1, ln_2 : layername \bullet \#\{c : connectorname \mid \\
\qquad sysconnector\ c.Source = syslayer\ ln_1 \land \\
\qquad sysconnector\ c.Sink = syslayer\ ln_2\} \leq 1 \\
\forall\, ln_1 : layername \bullet syslayer\ ln_1.id = ln_1 \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{System\_State} \\
\hline
sys : System \\
syslayer\_state : layername \rightarrow Layer\_State \\
\hline
\forall\, ln : layername \bullet syslayer\_state\ ln.l = sys.syslayer\ l \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{System\_State}\Phi\textit{Layer\_State} \\
\hline
\Delta System\_State \\
\Delta Layer\_State \\
layer? : layername \\
\hline
sys' = sys \\
syslayer\_state' \lhd \{layer?\} = syslayer\_state \lhd \{layer?\} \\
\theta Layer\_State = syslayer\_state\ layer? \\
\theta Layer\_State' = syslayer\_state'\ layer? \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{System\_Layer\_Compute} \\
\hline
System\_State\Phi Layer\_State \\
Layer\_Compute \\
\hline
\exists\, ln : layername \bullet layer? = ln \\
\hline
\end{array}
$$

$$
\begin{array}{l}
\textbf{System}\Phi 2Layer\_State \\
\hline
\Delta System\_State \Delta Layer\_State_1 \\
\Delta Layer\_State_2 \\
ln_1?, ln_2? : layername \\
\hline
sys' = sys \\
syslayer\_state' \ndres \{ln_1?, ln_2?\} = syslayer\_state \ndres \{ln_1?, ln_2?\} \\
\theta Layer\_State_1 = syslayer\_state\ ln_1? \\
\theta Layer\_State_2 = syslayer\_state\ ln_2? \\
\theta Layer\_State_1' = syslayer\_state'\ ln_1? \\
\theta Layer\_State_2' = syslayer\_state'\ ln_2? \\
\hline
\end{array}
$$

$$
\begin{array}{l}
System\_DeliverCallIn \\
\hline
System\Phi 2Layer\_State \\
\hline
\exists\, l_1, l_2 : layername \bullet ln_1? = l_1 \land ln_2? = l_2 \\
ctrl_1 = makecallout \\
ctrl_2 = ready \\
out_1 = l_2.l.id \\
port_1\ send\ out_1 \in l_2.l.export \\
\exists\, c : connectorname \bullet \\
\qquad \land\ sys.sysconnector\ c.Source.id = l_1.id \\
\qquad \land\ sys.sysconnector\ c.Sink = l_2.id \\
l_1' = l_1 \\
current_1' = current_1 \\
in_1' = in_1 \\
out_1' = out_1 \\
port_1' = port_1 \\
ctrl_1' = taked\_callout \\
l_2' = l_2 \\
current_2' = current_2 \\
in_2' = l_1.id \\
out_2' = out_2 \\
port_2' \ndres \{(receive, l_1.id)\} = port_2 \ndres \{(receive, l_1.id)\} \\
port_2'\ receive\ l_1.id = port_1\ send\ out_1 \\
ctrl_2' = receive\_callin \\
\hline
\end{array}
$$

$$
\begin{array}{|l}
\hline
\textit{System\_DeliverReturn} \\
System\Phi 2Layer\_State \\
\hline
\exists\, l_1, l_2 : layername \bullet ln_1? = l_1 \wedge ln_2? = l_2 \\[1ex]
ctrl_1 = send\_return\_callout \\
ctrl_2 = taked\_callout \\[1ex]
in_1 = l_2.id \\
out_2 = l_1.id \\[1ex]
port_2\ send\ out_1 = returnby?(port_1\ return\ in_1) \\[1ex]
\exists\, c : connectorname \bullet \\
\qquad \wedge\ sys.sysconnector\ c.Source.id = l_1.id \\
\qquad \wedge\ sys.sysconnector\ c.Sink = l_2.id \\[1ex]
l_1' = l_1 \\
current_1' = current_1 \\
in_1' = in_1 \\
out_1' = out_1 \\
port_1' = port_1 \\
ctrl_1' = ready \\[1ex]
l_2' = l_2 \\
current_2' = current_2 \\
in_2' = in_2 \\
out_2' = out_2 \\
port_2' \lhd \{(returned, out_2)\} = port_2 \lhd \{(returned, out_2)\} \\
port_2'\ returned\ out_2 = port_1\ return\ in_1 \\
ctrl_2' = receive\_return\_callout \\
\hline
\end{array}
$$

$$
\begin{array}{l}
Total\_System\_Compute \mathrel{\widehat=} \\
\qquad System\_Layer\_Compute \\
\qquad \vee\ System\_DeliverCallIn \\
\qquad \vee\ System\_DeliverReturn
\end{array}
$$

Nota: Faltaria armar lo de la traza, pero ya estoy hecho mierda! :), despues debo explicar todas las ideas de aca puse...por que de lo contrario despues se me escapan de la cabeza! ZZZZZZZZZZZZZZZZZ