Scalable and reusable models for HLA-Ptolemy cosimulation framework
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HLA three main goals

Interoperability
Plug and play federates inside a federation

Reusability
A federate can easily be used in another federation

Reproductability
Same results from one run to another
The HLA world

FOM
Classes : Attributes

HLA World

Federate 1
register objects
publish updates

HLA Objects

Federate 2
discover object
receive updates

RTI
actual data exchange
Reusability with the previous version

Goal

Reuse models from one simulation to another without any changes

Can’t make any assumption on the number of HLA objects to handle

Non scalable model
Key idea number 1

Use Ptolemy classes and objects to simplify the design phase

One HLA class -> One Ptolemy class with HLASubscriber inside
Key idea number 2

Instantiate a new actor when an object is discovered if needed

Minimal model design required

Previous model handling 3 objects
Federation:

- 3 bouncing balls, each own by a federate
- The display shown previous slide

Generic display that can be used with any Billard application.

The model will create new instances of Bille if needed and plug them to the ArrayPlotterXY.
What to do with new objects

Main idea

Use existing instances like role model

Visual explanation of the policy used
Removing an actor

\[ CR_{A_j} : H \mapsto \{ A_i \in H, i \neq j \} \quad (1) \]

Adding an actor

\[ CR_{A}^+ : H \mapsto H \cup \{ A \} \quad (2) \]

An atomic actor \( A \) is extended in

\[ A' = (I, O, S', s'_0, F', P', D', T') \quad (3) \]

with

\[ S' = S \cup \{ CR \} \quad (4) \]
Extended actor

\[ s'_0 = s_0 \cup \{ CR \mapsto \emptyset \} \]  \hspace{1cm} (5)

\[ F'(s, x) = \begin{cases} 
F(s, x) & \text{if } CR = \emptyset \\
\forall o \in O, o = \bot & \text{otherwise}
\end{cases} \hspace{1cm} (6)

\[ P'(s, x) = \begin{cases} 
P(s, x) & \text{if } CR = \emptyset \\
s & \text{otherwise}
\end{cases} \hspace{1cm} (7)

\[ D'(s, x) = \begin{cases} 
D(s, x) & \text{if } CR = \emptyset \\
0 & \text{otherwise}
\end{cases} \hspace{1cm} (8)

\[ T'(s, x, d) = \begin{cases} 
T(s, x, d) & \text{if } CR = \emptyset \\
(s, CR \mapsto \emptyset) & \text{otherwise}
\end{cases} \hspace{1cm} (9)\]
\[
\circ \ f(H) = \begin{cases} 
    f_1 \circ \cdots \circ f_n(H) & \text{if } H \neq \emptyset \\
    \text{Identity} & \text{otherwise}
\end{cases} \quad (10)
\]

\[
CRs = \bigcup_{i=1}^{n} CR \quad (11)
\]

\[
P'(s, x) = \{ P(s, x) \mid H \mapsto \circ \ f(H) \} \quad (12)
\]
For each iteration
execute Change Requests
initialize new actors
pre = director.prefire
    processHLAMessages()
if (pre = true)
    director.fire
    for each actor A to fire
        if (A.prefire)
            A.fire
            A.postfire
    director.postfire
Conclusion

- HLA and Ptolemy: both great technologies
- HLA-CERTI: tries to bring the best of them to model designers

- Tried to eased the designer life
- First good step, more work to do