Modelling Global and Local Name Spaces for Mobile Agents Using Object Nets

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A Scenario
A Scenario
A Scenario
**Object Nets**

**Definition** An *Object Net* is a tuple $OS = (\mathcal{N}, d, \Theta, M_0)$, where

1. $\mathcal{N} = \{N_1, N_2, N_3, \ldots N_n\}$ is a set of disjoint P/T-nets $N = (P, T, pre, post)$.
2. $d : P \rightarrow \mathcal{N}$ is the place typing.
3. $\Theta \subseteq T$ is a finite set of synchronisations.
4. $M_0 \in MS(\mathcal{P}(N_s))$ is the initial marking of the system-net $N_s \in \mathcal{N}$. 
Net Tokens

How to define Net Tokens [Val98]?

1. Net Tokens as References:
   • Assumes a global name space (→ side effects)
   • Easy to implement
   • Closely related to programming languages

2. Net Tokens as Values:
   • Assumes a distributed space
   • Easy to understand
   • Adequate for mobility
Reference Semantics
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References/Values

• Reference allows side-effects.

Value semantics is more powerful than reference semantics, e.g. reachability becomes undecidable (cf. [KR04]). Only for ordinary object nets both semantics coincide [KR05]. Mobility cannot be expressed adequately by reference semantics due to the possibility of side-effects (cf. [KMR03]). Value semantics inhibits global access. A generalised semantics is needed.
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Generalised Semantics

Building B

on:a3()

Building A

on:a2()

on:a1()

on:a4()

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Generalised Semantics
Generalised Semantics

Building B

Building A

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Generalised Semantics
Generalised Semantics

Building B

Building A

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Generalised Semantics
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Building B

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Generalised Semantics
Extended Object Nets

**Theorem [KR04]** A transition of an object net $OS$ is activated w.r.t. reference semantics iff it is in the p/t-net $fl(OS)$.

**Basic Idea:**

- Reference semantics is simulated by the p/t-net $fl(OS)$.
- Use $fl(OS)$ as a special token.
- Tokens can be transferred from an to $fl(OS)$.

**Benefit:**

- The formalism is a canonical extension.
- Most properties of object nets are preserved.
Generalised Semantics
Generalised Semantics
Generalised Semantics

Building A

Building B
Generalised Semantics

Building A

Building B

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Generalised Semantics
Generalised Semantics
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Generalised Semantics
Properties

Theorem Let $\theta$ be a transition that does not use $\mathsf{fl}(OS)$. Then $\theta$ is enabled iff it is enabled with respect to value semantics.

Theorem [KR05] Let $OS$ be an ordinary object net. Then $\theta$ is enabled w.r.t. reference semantics iff it is enabled w.r.t. value semantics.

Corollary Let $OS$ be an ordinary object net [KR05, Definition 6] that does not use $\mathsf{fl}(OS')$. Then $\theta$ is enabled iff it is enabled with respect to value semantics iff it is enabled for reference semantics.
Conclusion/Outlook

- Object Petri nets
- Reference vs. value semantics
- Global and local name spaces
- Generalised firing rule
- Generalised semantics as a special sub-class
- Most properties of object nets are preserved
Bibliography

References


