From Interaction Overview Diagrams to PEPA nets

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Motivation

- Model and analyse mobile systems.
- System consists of several locations. Some objects can move between locations. Within a location objects can interact with others.
- Choice of modelling language: for designers vs for analysis.
Motivation

• Model and analyse mobile systems.

• System consists of several locations. Some objects can move between locations. Within a location objects can interact with others.

• Choice of modelling language: for designers vs for analysis.

   UML 2.0 vs PEPA nets
Dynamic Models in UML 2.0

- Individual behaviour is modelled using state diagrams - intra-object behaviour.

- Collaborative behaviour is modelled using interaction diagrams - inter-object behaviour. These diagrams include
  - Sequence diagrams
  - Interaction overview diagrams (IODs)
Sequence diagrams

- Are a visual scenario-based formalism.
- Describe the instances involved in an interaction, and the messages exchanged for the interaction (partially ordered over time).
- Contain two dimensions: a vertical dimension denoting time; a horizontal dimension representing the instances involved in the interaction.
Sequence diagrams in UML 2.0

- Have new improved structure and expressiveness (through so-called *interaction fragments*)
- Loops and conditional branching can be indicated more clearly
- Parallel behaviour can be expressed as well as ordering of non-related communications
Sequence diagrams in UML 2.0

- Have new improved structure and expressiveness (through so-called *interaction fragments*)
- Loops and conditional branching can be indicated more clearly
  ```plaintext
  loop  alt
  ```
- Parallel behaviour can be expressed as well as ordering of non-related communications
  ```plaintext
  par  strict
  ```
Example Diagram

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Example Diagram
Ordering
Ordering

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Ordering

\[
\begin{array}{c|c|c|c}
\text{sd 3} & a & b & c \\
\hline
\text{strict} & m1() & m2() & m3() \\
\end{array}
\]
Ordering

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Interaction Overview Diagram

- High level structuring mechanism for sequence diagrams.
- Special kind of activity diagram with control flow only.
- Nodes are interactions (sequence diagrams); edges show the order in which these interactions occur.
- Uses forks, joins, decision and merge nodes from activity diagrams.
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Semantics of an IOD

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Flattening

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Flattening

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Which Case to Allow?

• Both interpretations are sensible: \textit{strong} and \textit{weak} sequential composition.

• We need different notation for each case.
Strong Sequential Composition

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Object Flow in ADs

1. Fill Order → Order → Ship Order
2. Fill Order → Order → Ship Order
3. Pick Materials for Order → Order → Assemble Order
   - Materials
   - Materials
Alternative input/output pins
Weak Sequential Composition

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IODs for Mobility

- Nodes represent locations in the system (interaction name).
- Explicit object flow is used to indicate object mobility.
- \{upperBound = value\} indicates the maximum number of tokens allowed in a pin.
- \{initBound = value\} indicates the initial number of tokens in a pin.
- \{weight = value\} indicates the number of tokens carried in an edge.
Secret Agents

intover SecretAgents lifelines 006, 007

download/r1

006;move/s4

process/r4

move/s3

load/r1

006;move/s2

save/r2

select/r3

Connection

MIS

Remote

006
Secret Agents

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