Real-Time Synchronised Petri Nets

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PN'02 / 24th June 2002

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Synchronised Petri nets

- Concurrent Object-Oriented Petri Nets
 - Object-Orientation
 - External and Internal Transitions
 - Synchronisation Requests
 - simple
 - simultaneity, sequence, alternative operators
 - transactional semantics (all or nothing)
 - Abstract Data Types

• This paper:

- Object-based
- Time stamped mono colored token











Semantics

- How to deal with:
 - Merlin-Farber and Synchronisations
 - Firing respecting Time interval
 - Tokens production time
- Synchronisation
 - Intersection of time intervals for simultaneity
 - Correct time of production of tokens for sequence
 - Non-determinism in the case of alternative

Inhibitor Arcs

• Ensure inhibitor arc condition even with chains of synchronisations

Semantics

- Structured Operational Semantics Rules (SOS)
- ▶ 4 Steps
 - Weak Transition System
 - Strong Transition System
 - Expanded Transition System (Synchronisation)
 - Observable Strong Time Semantics
 - paths starting from initial marking

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Expanded Transition System

Synchronisation

- move and put must fire at the same time
- result takes into account both firings
- Observable Transition: only move

Simultaneity

- Both transitions occur at the same time
- Observable Transition: e1 // e2

Expanded Transition System

Sequence

- Transition e1 fires before e2 (t1 < t2)
- Observable transition: e1 .. e2
- Tokens stamped at t1 and t2
- Tokens stamped at t2: not available before t2

Alternative

- Transition e1 or transition e2 fires at t
- Observable transition: $e1 \oplus e2$
- Tokens stamped at t
- Result: due to e1 or e2

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Conclusion

- Syntax and Semantics of Real-time Synchronised Petri Nets
- Towards:
 - Object-Oriented Real-Time Petri Nets
- True Operational Semantics already realised
 - first step towards reachability analysis
- Future Work
 - Axiomatisation: formal verification of properties