

Slides contain material from www.yawlfoundation.org

Developed by Wil van der Aalst, Michael Adams, Arthur ter Hofstede, Nick Russel

WORKFLOW NETS

Business 2710 – Class 10

Learning Objectives

- Understand the concepts of workflow nets
- Understand properties of workflow nets and be able to evaluate workflow nets
- Be able to transform Petri nets to workflow nets and vice versa
- Be able to model a simple business process as a workflow net



Textbook, Section 2.3

Petri Net Properties

□ Deadlock-free

- In every possible state (marking) of the petri net, there is at least one transition that is enabled

□ Dead transition

- A transition is dead, if there is no possible state of the petri net for which it is enabled

□ Live

- A transition is live if, from every possible state of the petri net, it can be enabled again
- A petri net is live, if all transitions are live

Petri Net Properties

- Bounded

- The number of tokens on each place in a net cannot grow arbitrarily

- Strongly connected

- For every pair of places and transitions, there is a directed path that connects them

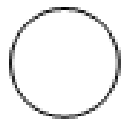
Workflow Nets

- There is a special place i (“source”) that has an empty preset of transitions
- There is a special place o (“sink”) that has an empty postset of transitions
- When transition t^* is added between o and i , the net is strongly connected
 - I.e. Every other place or transition is on a path from i to o
- Any workflow net must eventually terminate and there must then be exactly one token on o and all other places must be empty
- There should be no dead tasks, i.e. all transitions must be reachable

Workflow nets: Soundness

- **[Option to Complete]** Given an initial marking i , from every marking M reachable from i , a marking M' can be reached that covers o , i.e. and $M' \geq o$
 - In practical terms this means that the net is free of deadlocks and infinite loops
- **[Proper Completion]** Any marking M reachable from i that marks output place o , $M \geq o$, marks no other place and only has one token in o , i.e. $M = o$.
 - When the workflow terminates no other places are still marked and termination is signalled only once
- **[No Dead Tasks]** For every transition t , a marking M reachable from i can be found that enables t .
 - The workflow does not contain any superfluous parts that can never be activated

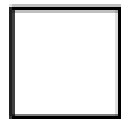
Workflow Net Constructs



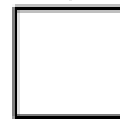
place



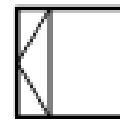
arc



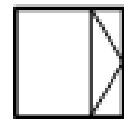
automatic task



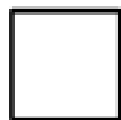
user task



explicit OR join



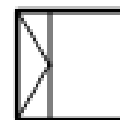
explicit OR split



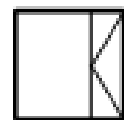
external task



time task

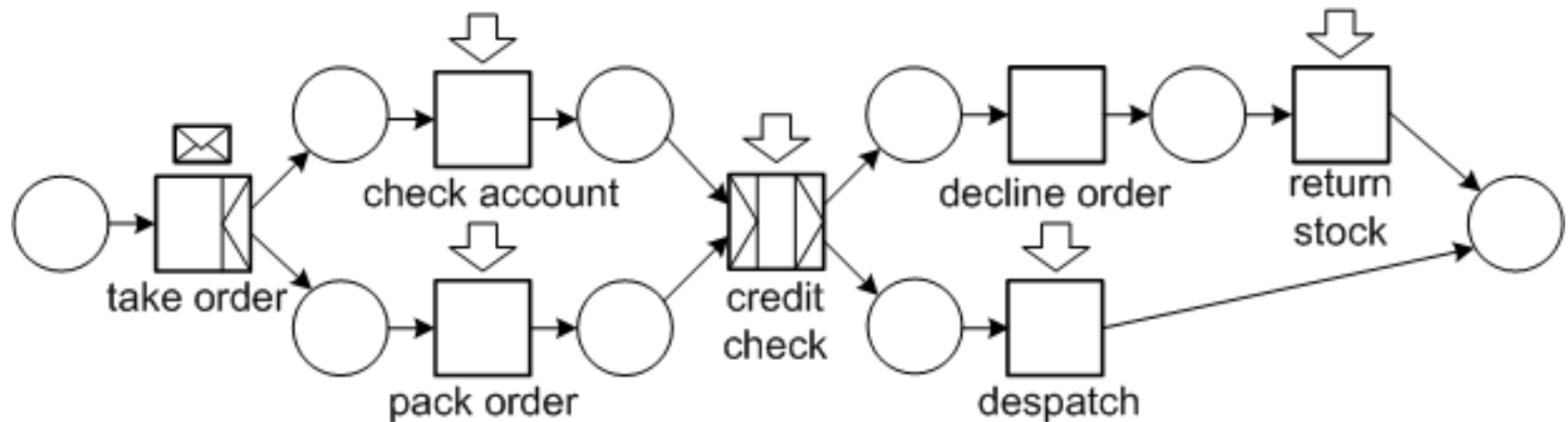


AND split



AND join

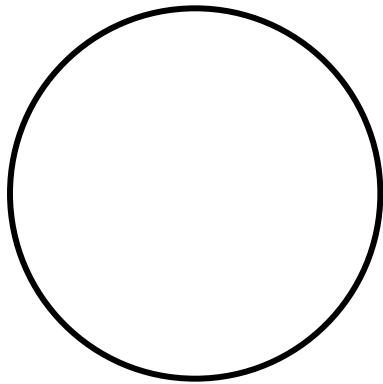
Workflow Net Example



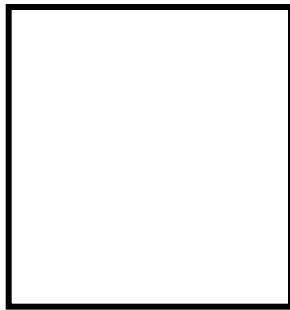
Reset Nets

- Reset nets extend Petri nets with a special type of arc, the reset arc.
- This directed arc connects a place to a transition
- Multiple arcs may point at the same transition
- **When a transition fires all tokens (if any) are removed from these so-called reset places**
- Reset nets can capture the notion of **cancellation**
- The reset arc extension comes at a price though: reachability is not longer decidable. Luckily coverability still is.

Reset Nets



place



transition

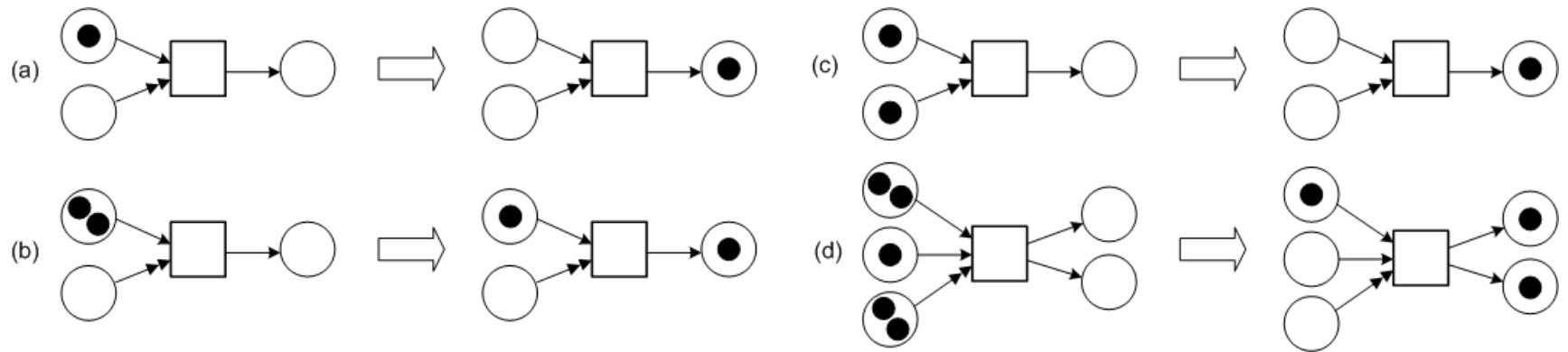


arc



reset arc

Rest Nets



Reset Nets

