Chair of Mobile Business & Multilateral Security

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Lecture 13

Business Informatics 2 (PWIN)
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Business Process Reengineering (BPR)

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Agenda

- Introduction
  - **Introduction**
  - Redesign of Business Processes
- Process-Oriented Modelling
  - Event-driven Process Chains
  - Petri Nets

Diversity of Terms

- Business Process, Business Transaction, Workflow, Process Chain, Operational Flow, ...
- Business Process Reengineering, Business Process Improvement, Business Process Innovation, Business Transformation, Business Engineering, Business Process Optimisation, ...

Business Process Working Definition

- **Working definition**

  Amount of manual, semi-automated or automated business activities that are executed according to certain rules towards a particular goal

- Activities are interlinked with each other, with respect to affected people, machines, documents, resources, etc.
- Activities are performed by human and non-human (machine) task managers.
- Tasks can be bundles of activities. A task itself can also be a deliverable with a measurable performance based on performing one or more activities.
- A business process generates a profit or value for customers.
- A collaborative business process activity is run by at least two task managers.

Source: Davenport (1993)

Examples for Business Processes

- An insurance company processing a claim settlement
- A bank processing a loan application
- A tax office processing a tax declaration
- An employee requesting their travel authorisation
- A customer applying for a credit card via the website of a bank
- …

Business Process Optimisation Approaches

- Two basic approaches to optimise business processes

Process improvement (e.g. Kaizen)

- Keep existing processes and attempt to continuously improve them

Process renewal (e.g. BPR)

- Radically rethink processes and redesign them from scratch

Business Process Reengineering (BPR)

- **Definition:**
  Business Process Reengineering is the **fundamental rethinking** and **radical redesign** of business processes to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service, and speed.

- Information Technology (IT) is a significant enabler for reengineering Business Processes (e.g. workflow management systems, ERP, etc.).

- Basic Steps for Business Process Reengineering:

Source: Hammer and Champy (1993)

BPR Objectives

Dramatically improve performance of business processes rather than merely “optimising” them, i.e.

- Improve **efficiency,** e.g. reduce time to market, provide faster response for customers
- Increase **effectiveness,** e.g. deliver higher process quality
- Achieve **cost saving** in the longer run
- Improve **financial performance,** e.g. in terms of sales, profits or profitability

Source: Kohlbacher (2010)

What does BPR constitute? (1)

An integrated program of change that ...

- delivers **substantial**, **measurable** improvements, often **rapid ones**;
- usually involves **cultural** and **job/role** changes, which must be managed accordingly;
- is typically 'enabled' through **IS/IT;**
- involves creative thinking (breaking the 'old' rules).

What does BPR constitute? (2)

An integrated program of change that ...

- is sponsored by **top/senior management** rather than the IS/IT function;
- is rather driven **top down** than bottom up;
- begins and ends with **customer value**;
- applies to multiple business functions, departments and/or locations, i.e. it is **process-oriented**.

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BPR – Identification and Analysis of current Business Processes

- Key activities by Davenport
  - Identification (modelling) of the current main processes
  - Definition of the process boundaries
  - Determination of the strategic relevance of the identified processes
  - Analysis of the needs for improvement of the current processes
- Output: Understanding of “as-is” processes

Source: Davenport (1993)

BPR — Process-Oriented Modelling of current Business Processes

- Process-Oriented Modelling
  - Description of all relevant aspects of a business process in a specific description language
  - Description languages

    e.g. Event-driven Process Chains (EPC) or Petri Nets

- Purpose of Process-Oriented Modelling
  - Understanding and documenting business processes
  - Reducing the complexity of business processes in order to enable a common understanding between stakeholders
  - Enable transparency for business processes

BPR — Design of new Business Processes

Problems:

- Little evidence about required new design, but many abstract metaphors (e.g. elimination, change of order, parallelisation, integration, avoiding media disruptions,…)
- Creative design process

BPR — Implementation of new Business Processes

BPR — Implementation of new Business Processes — Bottlenecks

- Organisational Bottlenecks
  - People as a bottleneck of behavioural change (it takes time for people to change their behaviour)
  - Implementation barriers
  - Special role of top management
  - Training for the role of process owners
- ICT Bottlenecks
  - Isolated solutions
  - Duration of implementation period
  - Adaptation of ICT
- Interaction between Organisational and ICT Bottlenecks
  - Implementation of optimised processes without considering ICT aspects is suboptimal.

BPR Review

- Use of ICT can be analysed, reproduced, and adapted.
- The complex arrangement of ICT, processes, and people, which evolved in long learning processes, is not easy to reproduce or adapt.
- BPR does not necessarily lead to dramatic performance improvements.

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  - **Event-driven Process Chains**
  - Petri Nets

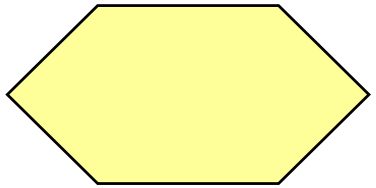
Event-driven Process Chains (EPC)

- History
  - Semi-formal, graphical description language
  - Developed in 1992 by Prof. Scheer (University of Saarbrücken) and staff.
  - Related ARIS Toolset is very popular in Germany.

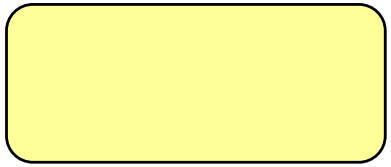
- Application
  - EPCs describe processes, i.e. related activity and process sequences.
  - An “event” is defined as the occurrence of an object or as changing a specific object property.
  - Events and activities may be combined with join operators “and”, ”inclusive or”, or ”exclusive or”.

EPC
Basic Graphical Symbols

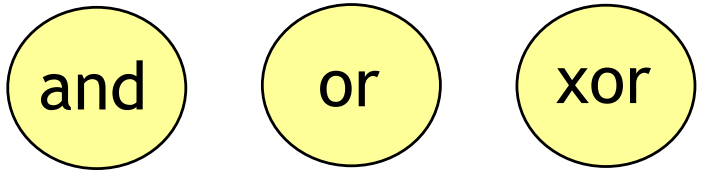
Event



Activity

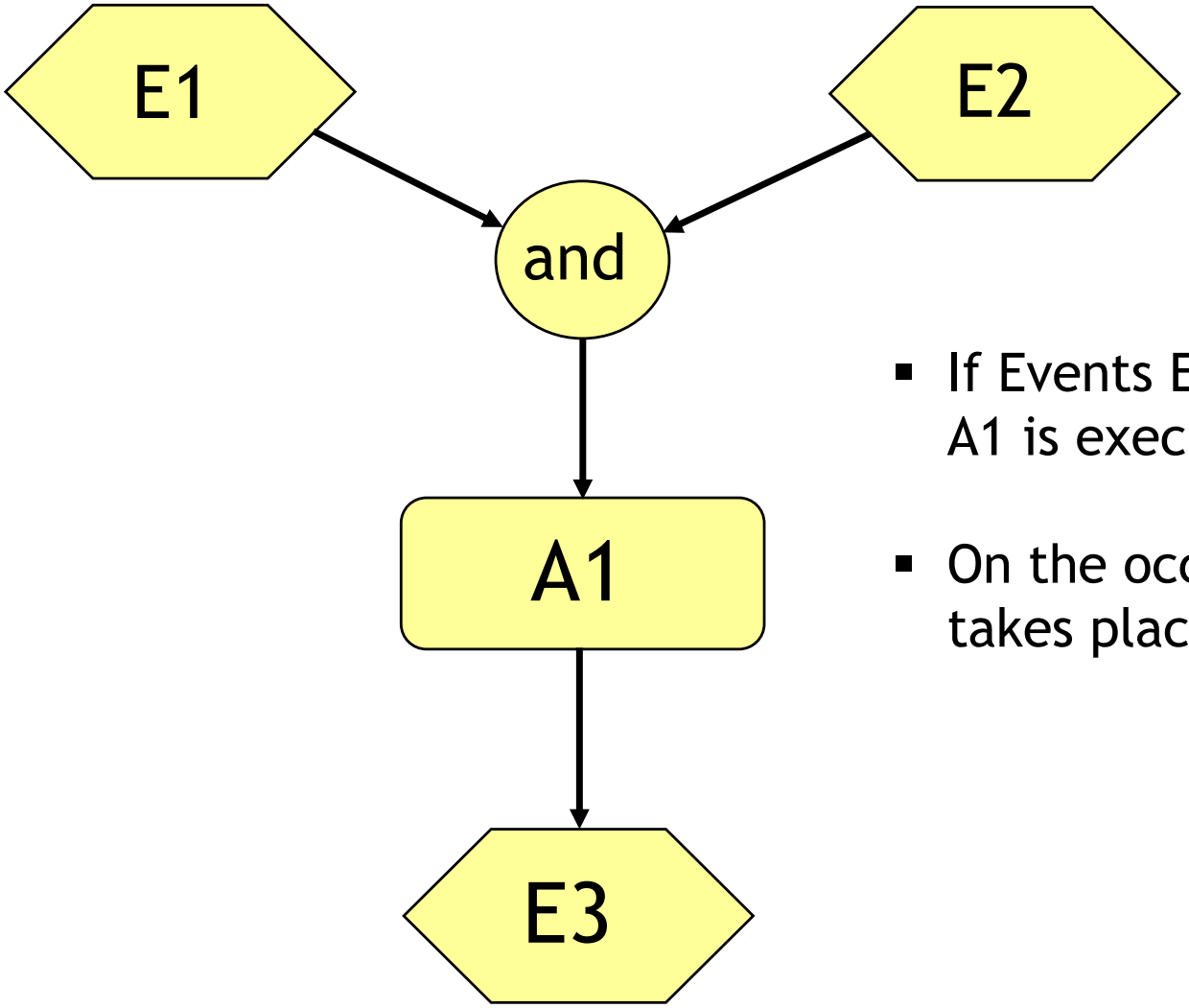


Join operators



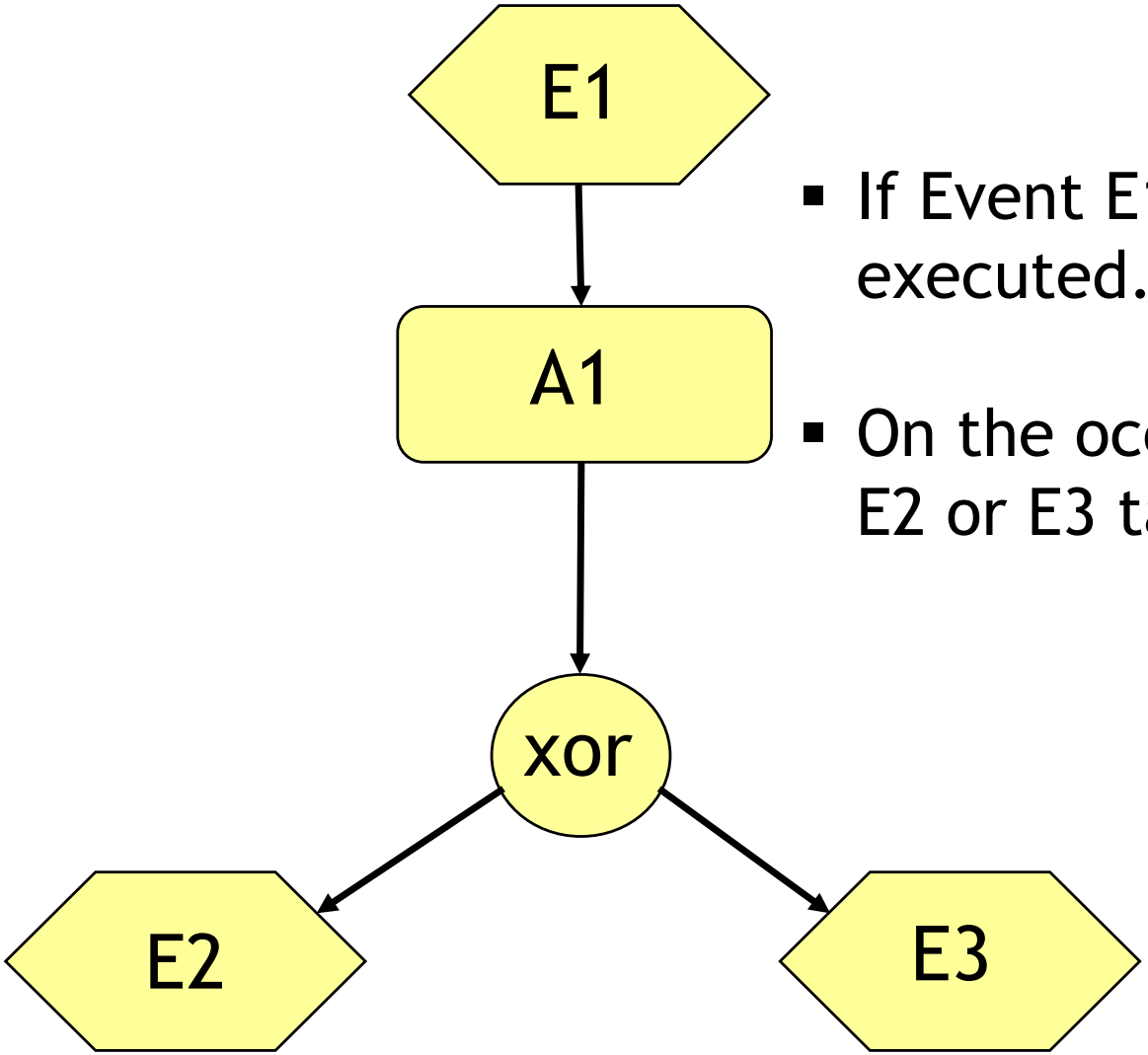
Dependency between
Event and Function

EPC
Example (1)



- If Events E1 and E2 occur, Activity A1 is executed.
- On the occurrence of A1, E3 takes place.

EPC
Example (2)

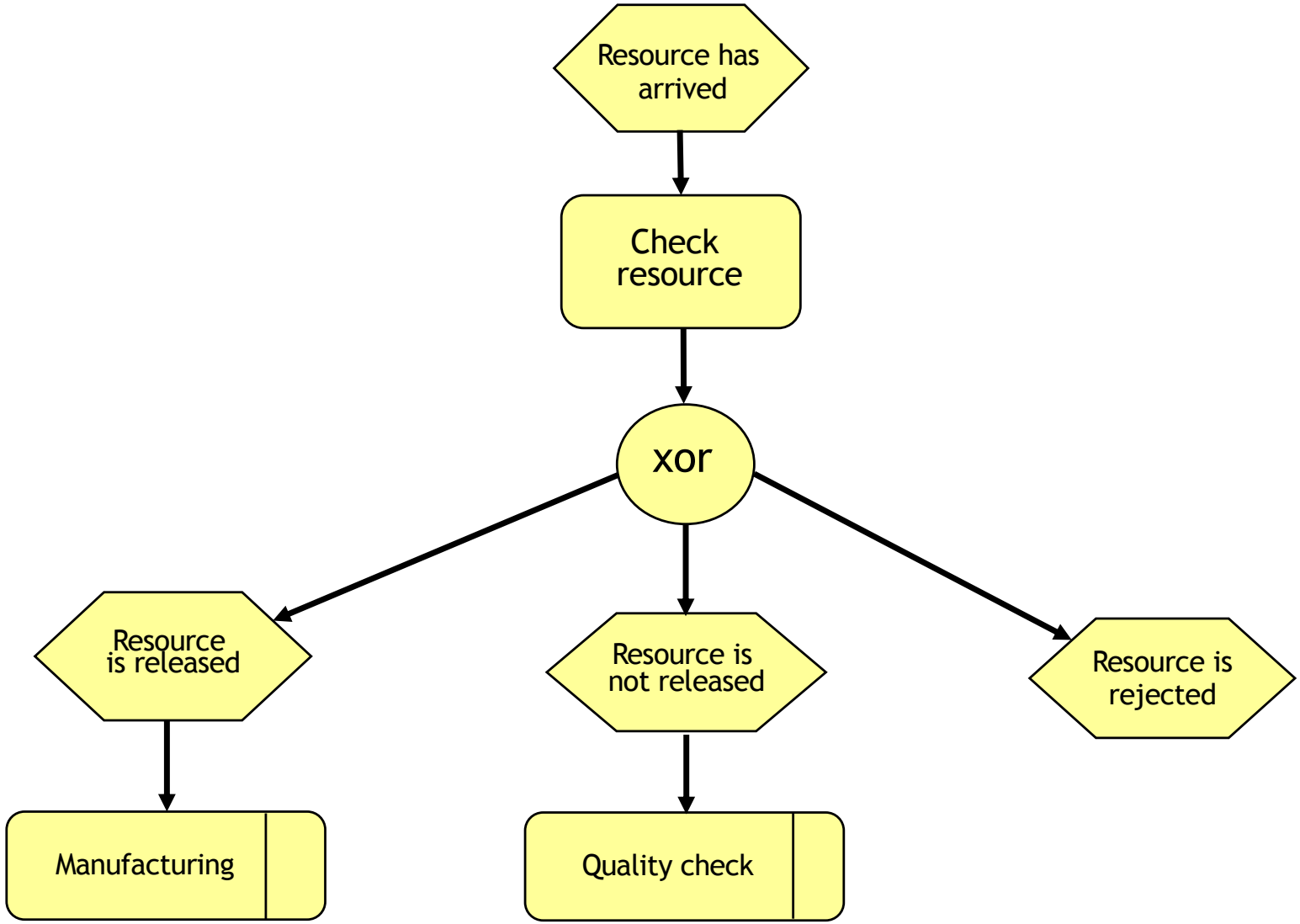


- If Event E1 occurs, Activity A1 is executed.
- On the occurrence of A1, either E2 or E3 takes place.

EPC
Start and Final Event

- Each EPC has to
  - start with at least one event (start event) and to
  - finish with at least one event (final event).
- Exception: Reference to another EPC

EPC
Start and Final Event Example

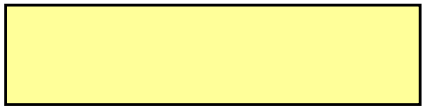


EPC
Refinement and Associations

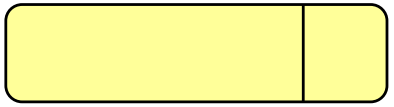
- Activities can be refined hierarchically.
- They can also be associated with
  - responsible organisational units or
  - incoming and outgoing data objects.

EPC
Refinement and Associations
Graphical Symbols

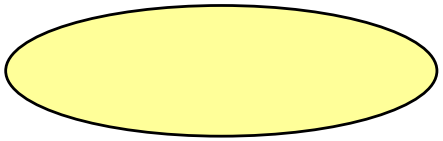
Data object / Physical object



Activity refined by an additional EPC



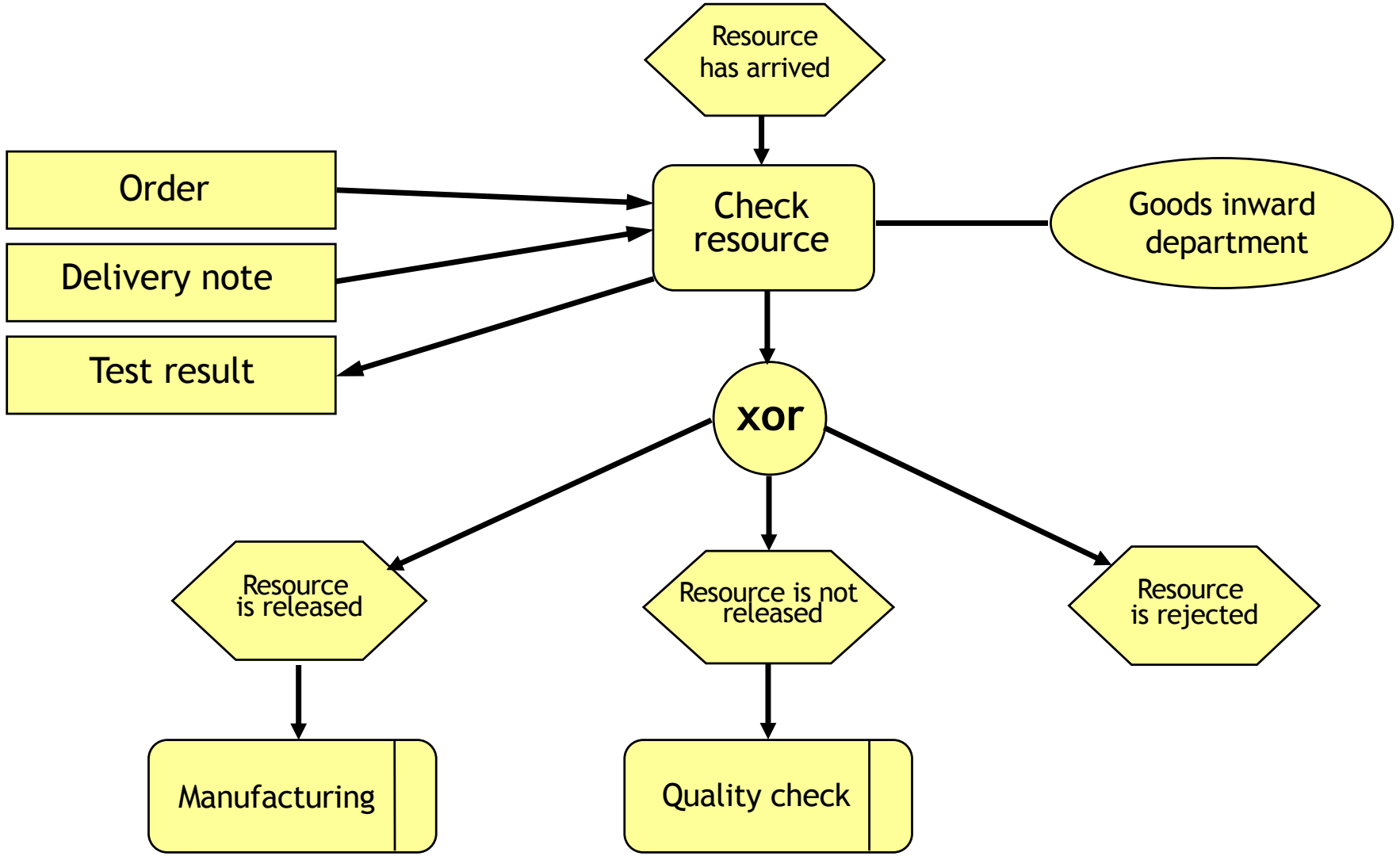
Organisational unit



Information flow

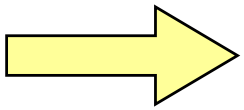
Association to organisational unit

EPC
Refinement and Associations Example



EPC Review

- Simple graphical presentation
- No precise meaning of each symbol, so no formal analysis possible
- Interrelations between objects and activities are often too inadequate for data modelling.
- Fails to distinguish between type and impact of a process



Not directly executable

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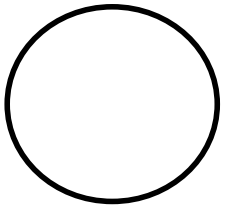
  - **Petri Nets**

Petri Nets

- Developed by C.A. Petri (1962)
- The graphical presentation of a Petri net is a bipartite graph with nodes and arcs.
- Two kinds of nodes:
  - Places: Typically represent resources or partial state of the system
  - Transitions: Represent state transitions and synchronisations
- Arcs in Petri Nets
  - are directed and
  - always connect nodes of different types.

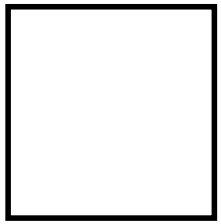
Petri Nets Symbols

- Place:



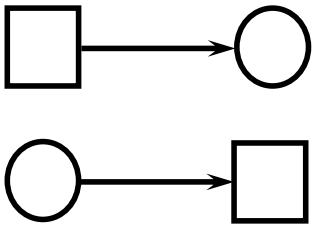
Interpretation:
State

- Transition:



Interpretation:
Activity

- Directed Arc:



Interpretation:
Input/output Relation

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Petri Nets
Formal Definition

A **Petri Net graph** (also called *Petri net*) is a 3-tuple , where

(i) S, T are finite sets

(ii) $S \cap T = \varnothing$

(iii) $S \cup T \neq \varnothing$

(iv) $F \subseteq (S \times T) \cup (T \times S)$

- The elements of S are called *places*.
- The elements of T are called *transitions*.
- Places and transitions are also called nodes.
- F is the ”flow relation”, which constitutes a set of arcs.

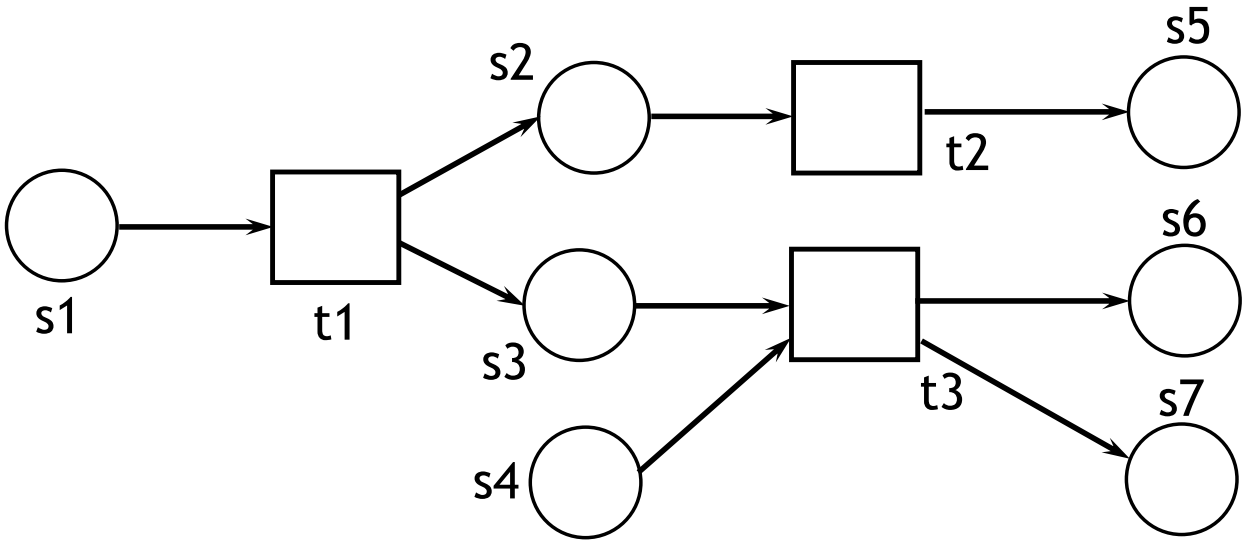
Petri Nets Example

The figure below shows the graphical representation of a network
N = (S, T, F)

S = {s1, s2, s3, s4, s5, s6, s7},

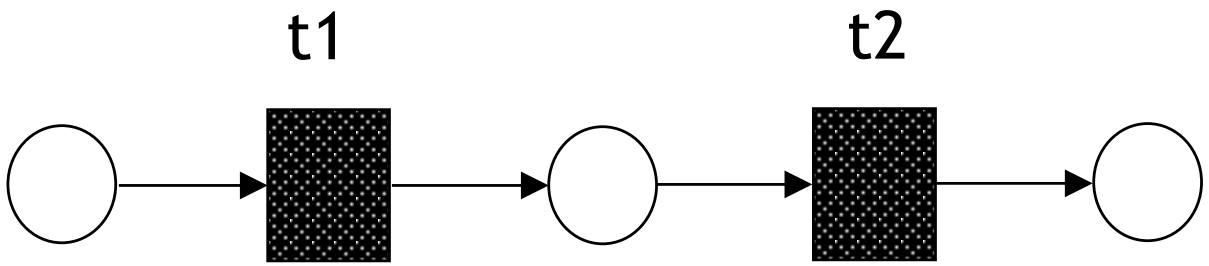
T = {t1, t2, t3} and

F = {(s1,t1), (t1,s2), (t1,s3), (s2,t2), (t2,s5), (s3,t3), (s4,t3), (t3,s6), (t3,s7)}

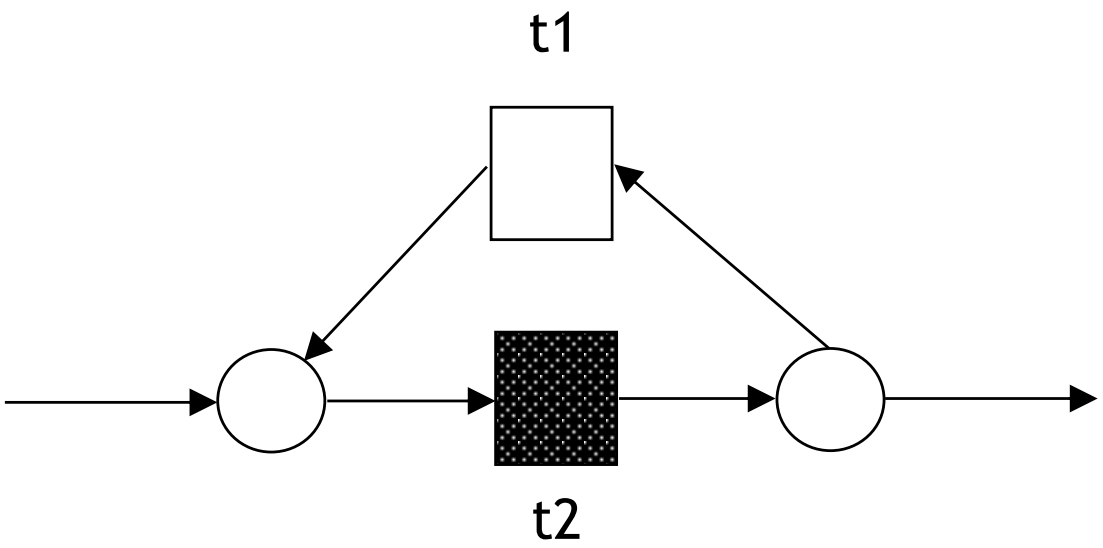


Petri Nets
Process Structures (1)

Sequence

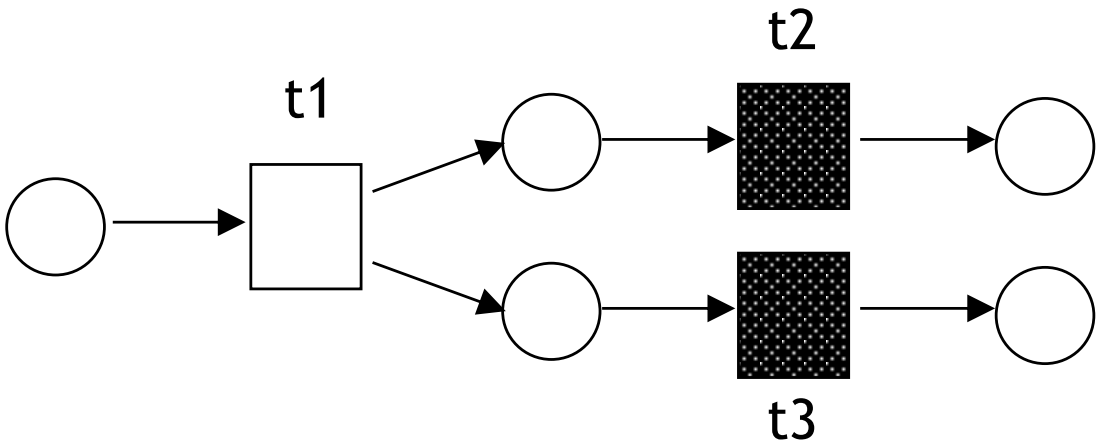


Iteration

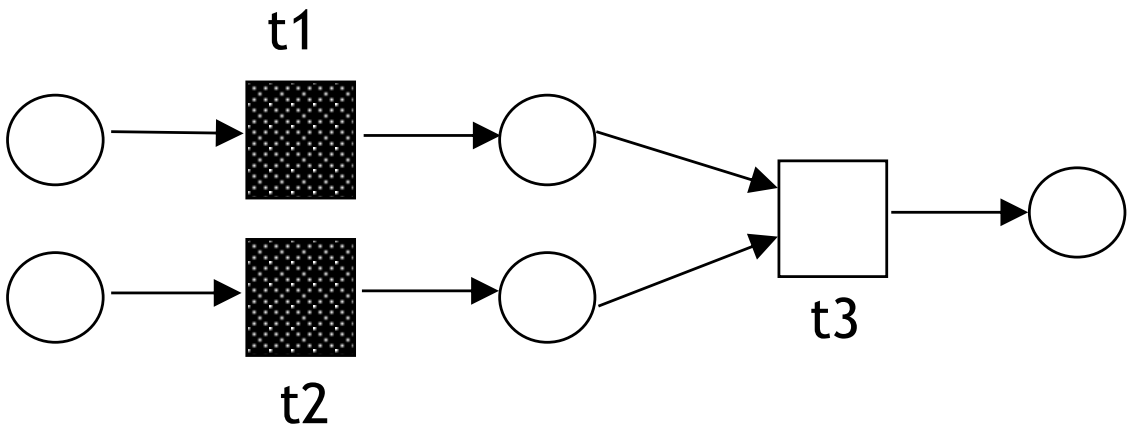


Petri Nets
Process Structures (2)

Concurrency

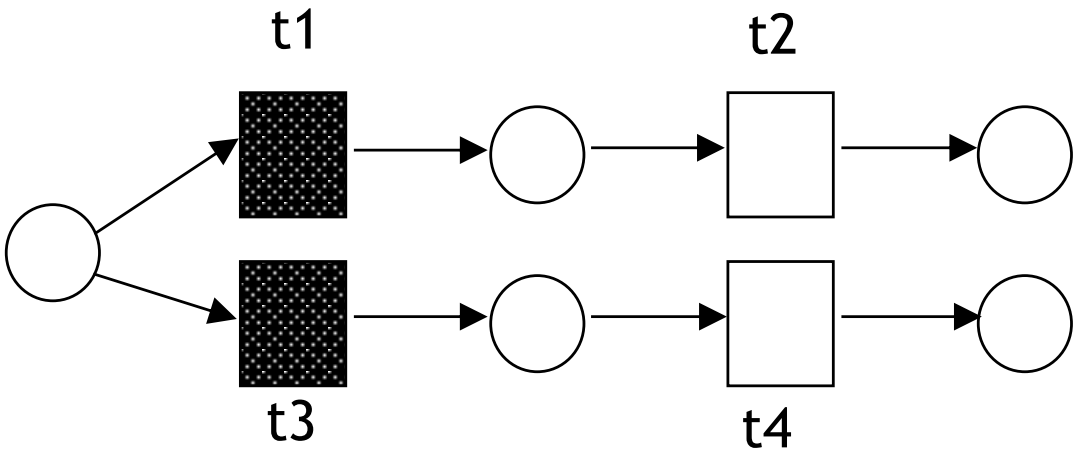


Synchronisation

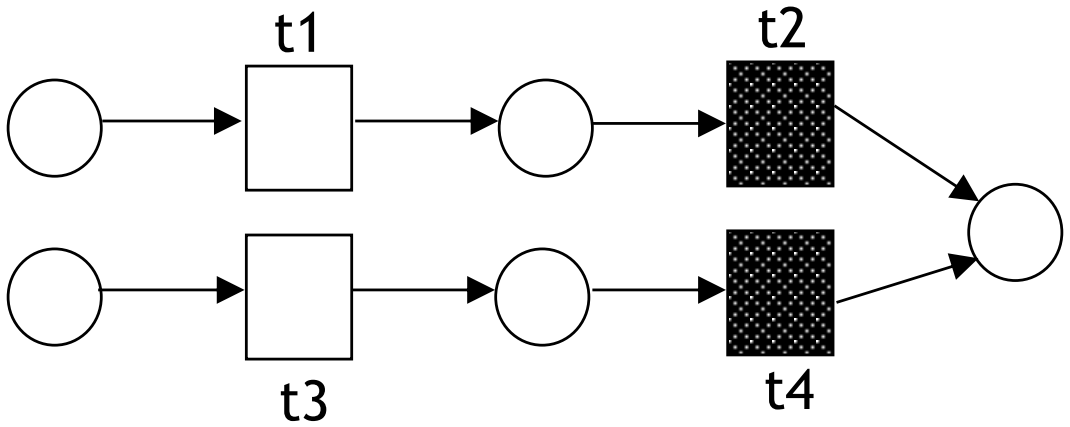


Petri Nets
Process Structures (3)

Selection
(Forward conflict)



Backward conflict



Petri Nets Review

- Integration of object-related aspects
- Directly executable (simulation)
- Allows gradual formalisation
- Mathematically based, can be formally analysed

Literature

- Davenport T. (1993): Process Innovation: Reengineering work through information technology. Harvard Business School Press, Boston 1993.
- Laudon, C.; Laudon, J.P.; Schoder D. (2010): Wirtschaftsinformatik´: Eine Einführung, Pearson Deutschland GmbH, 2. Auflage, 2010.
- Keller G., Nüttgens M., Scheer A.W. (1992): Semantische Prozeßmodellierung auf der Grundlage Ereignisgesteuerter Prozeßketten (EPK). Erschienen in der Reihe: Veröffentlichungen des Instituts für Wirtschaftsinformatik. A.-W. Scheer (Hrsg.). Heft 89, Saarbrücken 1992.
- Hammer, M. and Champy, J. A.: (1993) Reengineering the Corporation: A Manifesto for Business Revolution, Harper Business Books, New York, 1993.
- Kohlbacher, M. (2010): The effects of process orientation: a literature review. Business Process Management Journal, 16(1), S. 135-152, 2010.