

## Business Process Modelling with BPMN

Dr Balbir S. Barn

[bbarn@acm.org](mailto:bbarn@acm.org)

<http://cova.tvu.ac.uk/cova>

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## Course Outline

- 10:00: Session 1: Background and Concepts
- 11:15: Coffee Break
  - JISC project experiences
- 11:50: Session 2: Introduction to BPMN
- 12:30: Lunch Break
  - Tutorial Exercise 1
  - Tutorial Exercise 2
- 14:00: Session 3: Methodology Guidance
  - Tutorial Exercise 3
- 15:00: Coffee Break
- 15:30: Session 4: General Issues
- 16:30: Workshop close

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## Session 1: Background and concepts

- This session will cover:
- Aims of the workshop
- Business process definitions and theoretical base
- Business process characteristics
- The purpose of process modelling
- Key concepts


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## Workshop Aims

- Delegates will attain a basic understanding of
  - Principles, concepts and techniques of business process modelling and workflow;
  - The role of workflow and process models in the analysis, design and implementation of information systems;
  - The OMG standard – Business Process Modelling Notation (BPMN);
  - Applying the BPM Notation to defining and describing business processes;
  - Alternate technologies and notations for workflow modelling
  - The role of methodology in process modelling

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## What is a Business Process?

- Davenport & Short (1990) define *business process* as
  - "a set of logically related tasks performed to achieve a defined business outcome." A process is "a structured, measured set of activities designed to produce a specified output for a particular customer or market."
- Business processes as transformations of inputs to outputs
- Other models available:
  - Language-Action-Perspective (LAP) (Winograd and Flores 1986)
    - Production, coordination tasks using language for communication

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## Process Characteristics

- Organizations do things to achieve their objectives
  - Recruit staff
  - Design new products
  - Run an investment portfolio
- Processes tend to be large things
  - Activities – things are done
  - Process has goal to achieve something
  - Involve more than one person
  - Take time
  - Course Validation!
- Process – a coherent body of organizational activity
- Things that it isn't:
  - Not functional group – e.g. credit control – they take part in processes – so HR process is meaningless.

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## Why Model?: Organization Design

- Process Documentation
- Process Reorganization
- Process Monitoring and Controlling
- Continuous Improvement
- Quality Management: ISO 9000
- Benchmarking: Compare with best practice
- Knowledge Management

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## Why Model?: Information Systems Design

- Selection of ERP software
- Model based Customizing
- Software Development
- Workflow Management
- Simulation

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## Historical Contexts

- Organizations have been structured around Adam Smith's idea to break down work into simple discrete tasks performed by workers with basic skills (c.f. Taylorism)
- Organizing by Function leads to:
  - Loss of flexibility
  - Inability to respond to customers quickly

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## Business Process Re-Engineering – the 1st wave

- Business Process Re-Engineering was seen as an appropriate remedy:
  - 1990: Davenport and Short
  - 1990: Hammer: "Don't automate, obliterate"
- Focus on the horizontal view on how things are done and not who decides.... (organizational charts)
- Characterised by:
  - High failure rates
  - Loss of knowledge
  - Dependent on immature ERP technology

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## Business Process Change – the 2<sup>nd</sup> wave

- 1994 – 2002: Questions on the validity of the clean slate approach
- Instead a focus on **continuous business improvement** and cross organizational processes
  - Made possible by maturing ERP technology and interchange

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## Business Process Management – the 3<sup>rd</sup> wave

- 2003 - now
- Organizations need to move away from hard coded processes (Smith and Fingar 2003)
- Supports both business improvement (as is – to be modelling) and process innovation (the future)

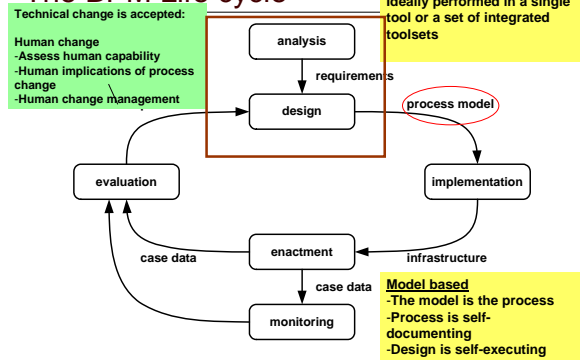
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## Business Process Management

- **Business Process Management (or BPM)** refers to activities performed by organizations to manage and, if necessary, to improve their business processes
- Made possible by new tools, technologies and standards
- Activities include:
  - Process Design
  - Process Enactment
  - Process Monitoring

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## The BPM Life cycle



## Types of Processes

- **Core Process**
  - Satisfy external customers
  - Directly add value to the business
  - They respond to a customer request and generate customer a satisfaction
- **Supporting Process**
  - Satisfy internal customers
  - Does not directly add value to the business
- **Process Patterns**
  - Case Process – entity passed between roles that perform some update on the entity
  - Event Driven Process – event is raised and a process executes in response to the event
  - Cycle-Driven Process – single process happens periodically – only one such instance
  - State Maintaining Process - maintain the state of one or more objects

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## Basic Concepts

- In an organization people do work
- At an individual level: Bill writes letters to students on the success of their Scholarship application
- Individuals collaborate / interact with others to achieve goals
  - Some actions are carried out together
    - Interaction patterns include:
      - You and I discuss something
      - I contract you to do something
      - I pass information to you
      - I delegate a task to you
      - I ask you for something
      - You and I agree on action
      - You and I jointly approve on an action
      - I wait for you to do something
      - I oversee something you are doing

A pattern language for interactions!

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## Basic Concepts

- Work is done by following rules:
  - If the customer is late with a payment an extra charge is added
  - A house in a flood plain has its insurance premium calculated differently
  - Sometimes there is strict governance required
    - Policy: e.g. nobody can approve their own work
    - Procedures: for planning and reporting on projects; sign off on purchases;
    - Standards – use of a particular styles

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## Roles

- At an individual level: Bill writes letters to students on the success of their Scholarship application
- However people do not do things because they are themselves but because they have a responsibility – paid – they have a role
  - A hat of responsibility!
- What are the roles in a supermarket?
- A publishing company?

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## Roles

- Roles can be large – “Finance, Marketing etc”
- Roles can be transient – “Customer”, “Expense Claimant”
- Roles are “Types”
  - They have instances
- Types of Roles
  - A unique functional position – VC
  - A generic functional position – Head of Dept
  - A unique functional group – Registry, Academic Office, Finance
  - A generic functional group – Department, Site
  - A generic type of transient role – Customer, House Purchaser

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## Actions: Activities and Tasks

- Actions are what people in their roles do to carry out their responsibilities
- Examples
  - To develop a new drug:
    - Choose lead molecule; Carry out a Clinical Trial
  - To buy a house
    - Select Estate Agent; Arrange Mortgage Offer
  - To Enrol a Student
    - Carry out identity check; Arrange Payments

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## Ordering of Actions

- Actions have relationships that are used to define the ordering of actions
  - Sequential
  - Conditional
  - Concurrent
- Actions are triggered off by external or internal events
- A set of ordered actions is a process

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## What to model of a business process

- Activities and Tasks
  - synchronization
  - decisions
  - parallel work
  - repetition
  - ...
- Organizational responsibilities
- Required resources and constraints
- Information input and output
- ...

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## Approaches to Process Modelling

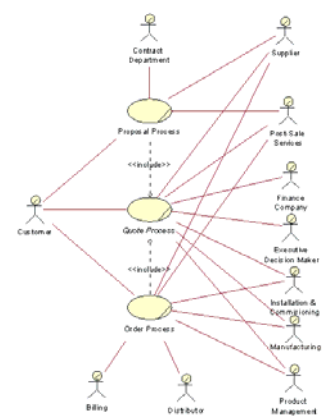
- Rational Unified Process (Activity Modelling)
- Business Process Modelling Notation - BPMN
- STRIM (Ould 98) (partially LAP)
- IDEF0 (Functional decomposition)
- Others:
  - Information Engineering...

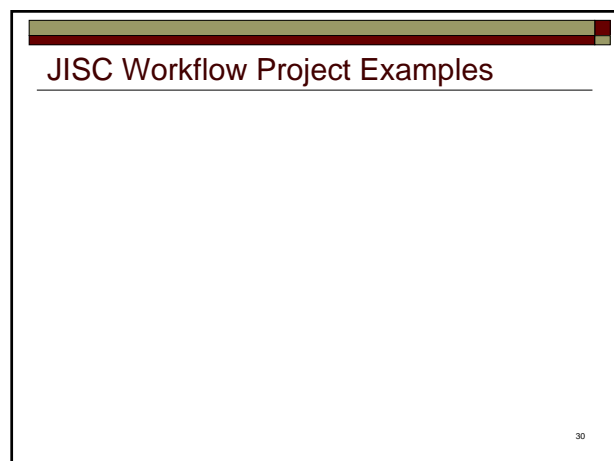
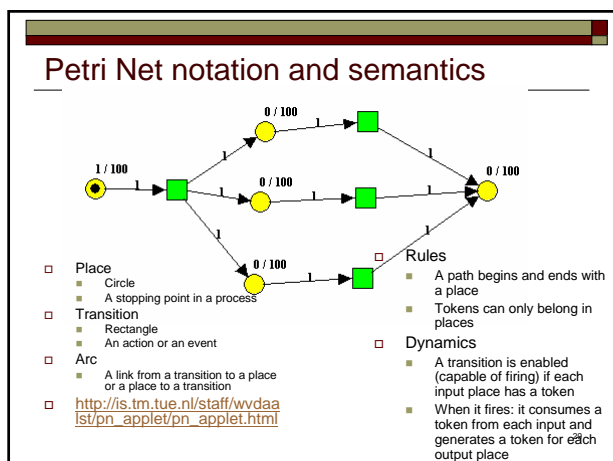
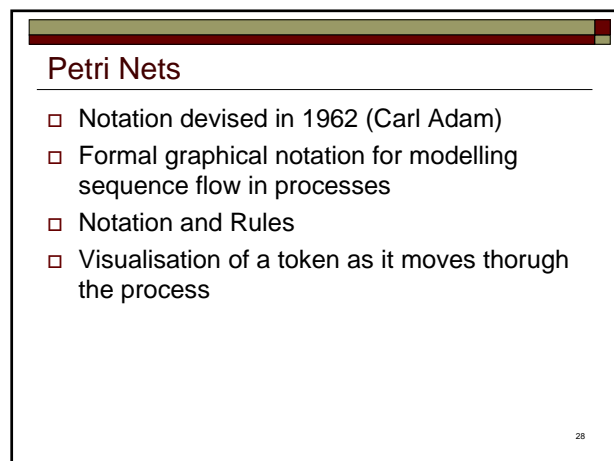
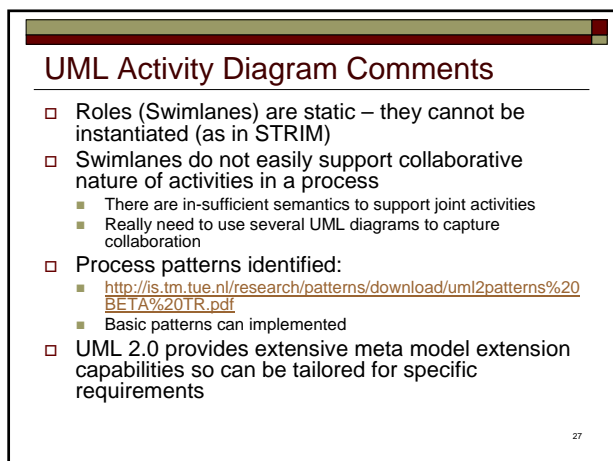
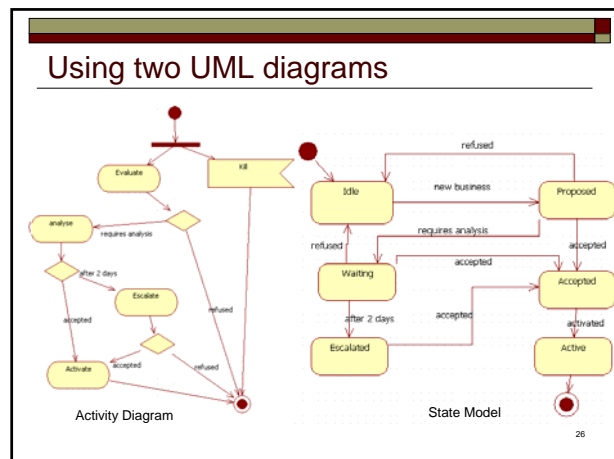
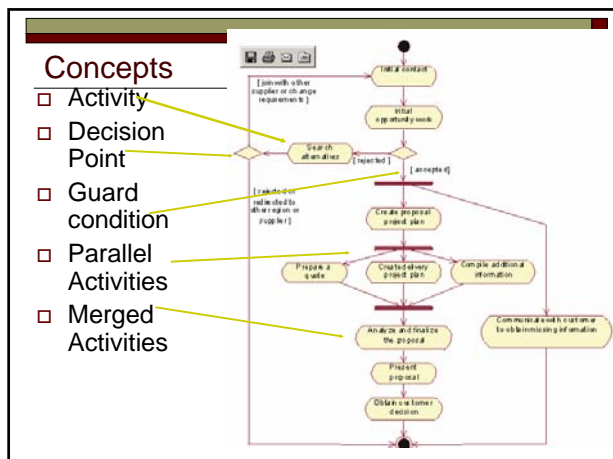


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## RUP/Activity Modelling

- Use Case Models at the Business Process Level
- Business Actors
- Business Use Cases





## Session 2: Introduction to BPMN

- BPMN background
  - History
  - Purpose
- Basic concepts
  - Notation set
- Tutorial Exercise 1
- Further concepts
  - More notation
- Tutorial Exercise 2

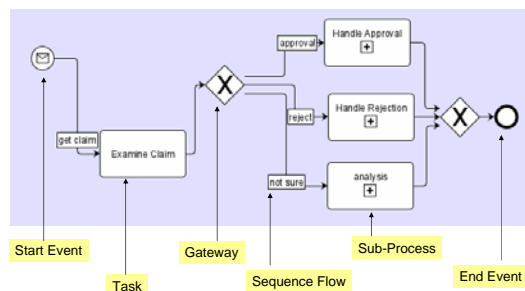
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## What is BPMN?

- Business Process Modelling Notation – BPMN
- A flowchart based notation for defining business processes
- An agreement between many modelling tool vendors to use a single unified notation
  - Benefits to end users in terms of training
- Enables generation of an executable business process from business level understanding

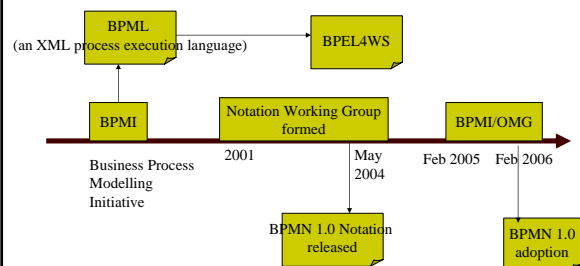
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## A sample business process in BPMN



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## A short history of BPMN



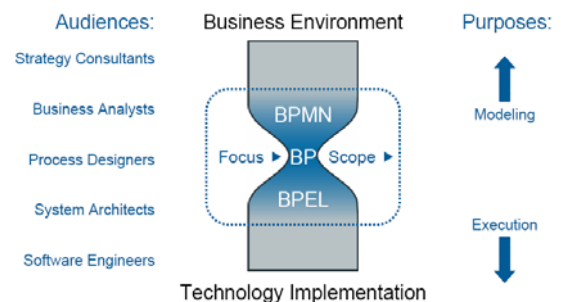
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## BPMN Goals

- Adoption by the business community
  - General business purposes as well as execution
- Model driven base to enable
  - Specification to generation of executable business processes
- Method neutral
  - Similar principles to UML
  - Methodologies will provide information and guidance on purpose, how to and details of modelling
- As complex as it needs to be

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## Business Process Management scope



## BPMN and extensibility

- BPMN is designed to be extensible by modellers and toolsets
- Can add (e.g. for a vertical domain)
  - New artifacts
  - Can be associated with Flow objects
  - Can annotate flow objects with new specialised markers
- Restrictions
  - Can't introduce new flow elements (no rules on connectivity)

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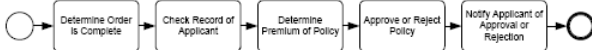
## BPMN diagrams and scope

- BPMN provides one diagram with one set of notations (contrast with UML)
- Diagrams can have:
  - Different scope (point of view)
    - From the view of a particular participant
    - The scope of an overall diagram
    - No specific semantics in the notation (left to the user)
  - Address different types of process
    - Private (internal) business processes
    - Abstract (public) processes
    - Collaboration (global) processes

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## Private Internal Business Processes

- Internal to a specific organization
- Normally associated with workflow
- Constrained within a single Pool
- No sequence flows can leave the Pool



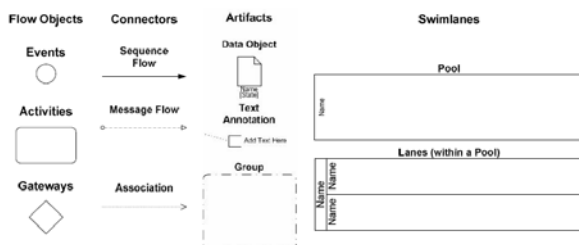
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## Abstract (Public) Process

- Represents the interactions between a private process and another process or participant.
- Presents the sequence of message flows that define dependencies between process and the external participant

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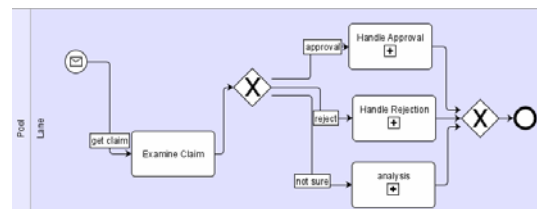
## Basic Notation Set



The basic notation set will look familiar to most business analysts and is fundamentally a flowcharting notation for capturing basic business process models.

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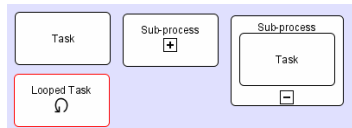
## Using the basic notation set



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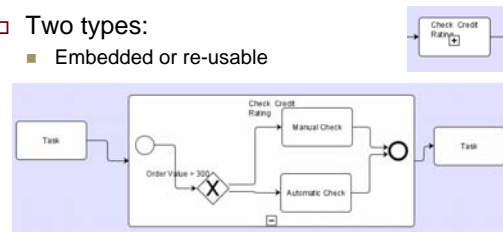
## Activities

- An activity is a generic term for work that a company performs.
- An activity can be:
  - Sub-Process – a compound activity included within a process – that can be broken down into further detail
  - Atomic – A Task
  - A task that happens once or can have internally defined loops
- Tasks can be annotated
- An extension point



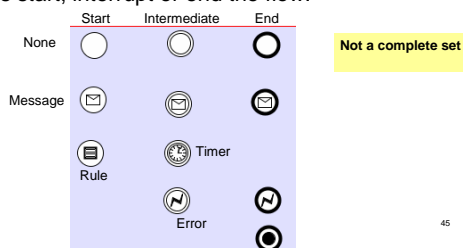
## Sub-Processes

- Support hierarchical process structures
- Compound structure
- + - notation
- Two types:
  - Embedded or re-usable



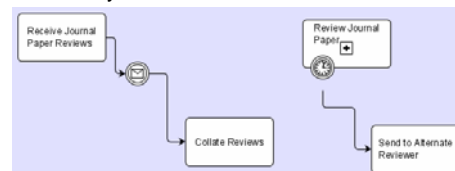
## Events

- An **Event** is something that “happens” during the course of a business process.
- The sequence of flow in a process can be altered.
- Events start, interrupt or end the flow.



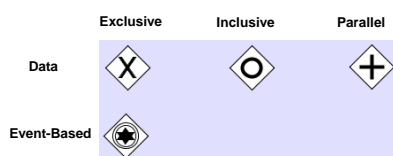
## Intermediate Events

- These occur after a process has started and before it has ended
- Different “triggers” represent different event types (adornments on the basic event icon)
- Placed on “normal” flow or attached to the boundary of a task



## Gateways

- Modelling elements for controlling the sequence flow of a business process
- Basic notation is a diamond
  - Internal markers indicate different type of behaviour



## Exclusive Gateways

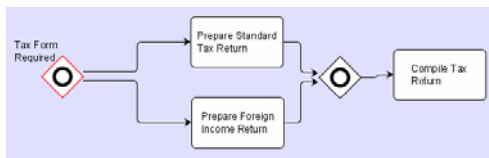
- Locations in the business process where the sequence flow can take two or more alternate paths (“fork in the road”)
- Only one possible outgoing path is possible
- Decisions can be based on
  - Data (conditional expressions)
  - Events (receipt of alternate messages)





## Inclusive Gateways

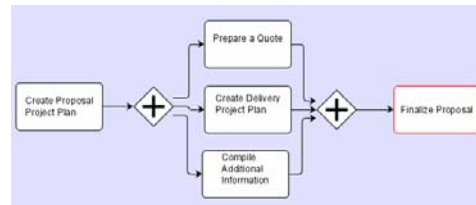
- Inclusive gateways are decisions where there is more than one possible outcome
- The “O” marker identifies this Gateway
- Every branch that is true executes
- There is usually a corresponding merging Gateway



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## Parallel Gateways

- Multiple parallel paths are defined
  - Not forking
- Gateway used to synchronize parallel paths



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## Connectors

- Sequence Flow
  - The order in which activities are performed
- Message Flow
  - The flow of messages between two entities – a collaboration.
- Association
  - Linking data, information with flow objects



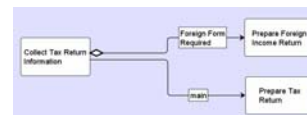
Association



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## Sequence Flow

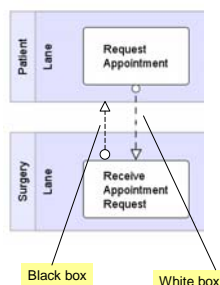
- Sequence Flow
  - Ordered activities
  - Source and Target must be a:
    - Event
    - Activity
    - Gateway
  - Sequence flows cannot cross sub-process or Pool boundaries
- Conditional Sequence Flow
  - A sequence flow may have a defined exit condition (evaluating TRUE)
  - There must be at least two exit sequence flows



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## Message Flow

- A Message Flow is used to show the flow of messages between two Participants of a Process (represented by Pools)
- Message Flows can connect to the boundary of a Pool or to an object in the Pool
- Message Flows are not allowed between objects in the same Pool



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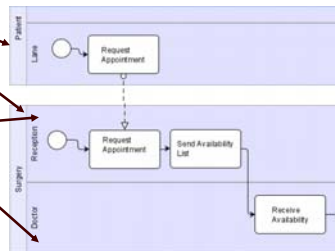
## SwimLanes

- Work is organized and occurs in areas of an enterprise
- BPMN uses SwimLanes to help partition and organize activities.
- There are two types of swimlanes:
  - Pool: represents Participants in an interactive B2B Business Process Diagram
  - Lane: represents sub-partitions for the objects within a Pool

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## Pools and Lanes

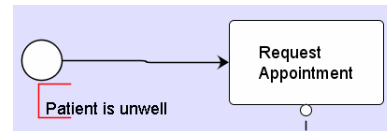
- Pools – representing participants
- Lanes – representing sub-partitions
- Sequence flows cannot cross sub-process or Pool boundaries



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## Text Annotations

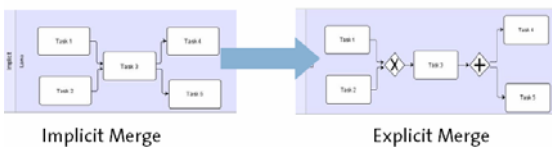
- Text Annotations are a mechanism for a modeller to provide additional information about a Process
- They can be connected to specific objects with an Association



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## Implicit Merge vs Explicit Merge

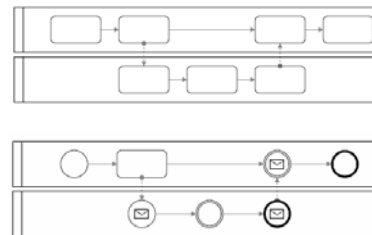
- BPMN is based on the concept of tokens (like Petri Nets)
- BPMN supports implicit merge
- Implicit merges can lead to wrong interpretations
- As a best practice, try using explicit merge



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## Tasks vs Events

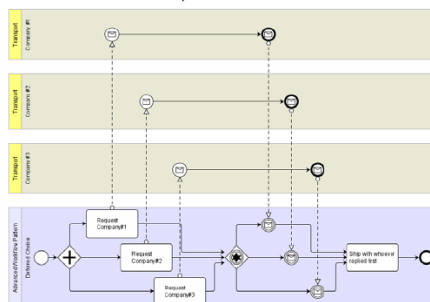
- Exercise: Re-model the following model with as many event shapes as possible.



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## Examples

Products are ready to be shipped. We send a separate message to 3 Transport companies we work with to ask them to ship the products. Whichever company replies first with a message saying they are ready to proceed will be selected for shipment.



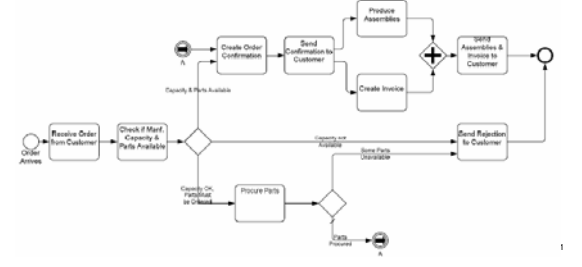
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## Further Concepts

- Link Events
- Data Flow
- Timers
- Looping
- Exception Handling
- Ad Hoc Processes

## Link Events

- Use Link Events as “Off-Page” connectors
- Use Link Events as “Got To” objects

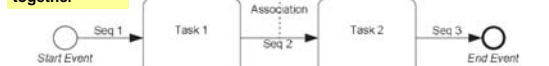


## Data Flow, Data Objects and Associations

Sequence Flow and Data Flow are decoupled

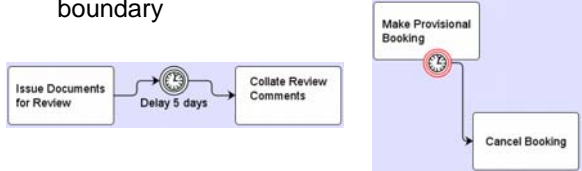


Sequence Flow and Data Flow bound together



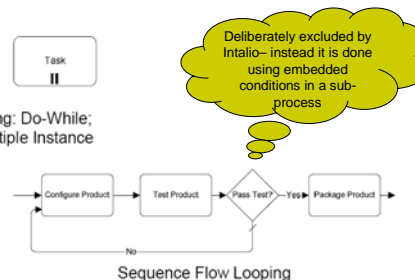
## Timers: Intermediate and Interrupts

- Timer Events can be placed within a sequence flow to add delays
- Timers can be used as Timeouts for exception handling by placing on a Task boundary

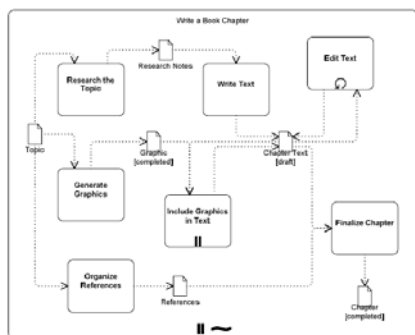


## Looping

Activity Looping: Do-While; While-Do; Multiple Instance



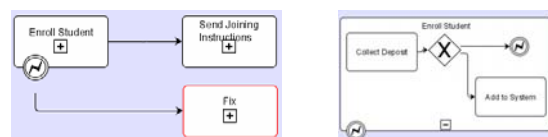
## Ad Hoc Processes



There is no pre-defined Sequence Flow

## Exception Handling

- When “Enroll Student” completes successfully the “Send Joining Instructions” Activity is performed
- If an exception occurs control passes to “Fix”



## Exercise 1: Notation Test

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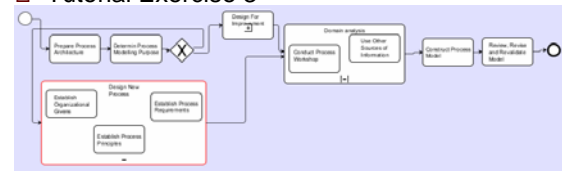
## Exercise 2: An expense claim process

- Consult the case study material
- Working in groups of three or as pairs produce a process diagram using the BPMN notation

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## Session 3: Just Enough Methodology

- Purpose
  - To introduce some basic methodological approaches to process modelling
- Basic Process
- Tutorial Exercise 3



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## Prepare Process Architecture

- Understand the Units of Work (UoW)
- Identify Core Business Entities
- Name Case Business Processes that map to handling Units of Work

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## Units of Work and Case Processes

- A unit of work arrives and is dealt with
- It is the thing that organizations or departments within organizations do!
  - What does Postgraduate Admissions do?
    - It deals with postgraduate applications from potential applications
  - What does an Insurance Claims Dept do?
    - It deals with claims!
  - *Applications* and *claims* are examples of units of work
- Exercise:
  - Take a moment to jot down the units of work in your department or organization

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## Case Process

- Units of Work arrive as case “episodes”
- Each “episode” must be dealt with
- A Case Process is the uniform, repeatable (documented) way of dealing with a case
- Case Process Naming
  - When a unit of work is a trigger for a set of activities then name the Case process:
    - Handle <Unit of Work> e.g. Handle Customer Complaint
  - When a unit of work is an output then:
    - Prepare <Unit of Work> e.g. Prepare Research Bid
- Why use the “Handle” construct?

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## Identify Core Business Entities

- Core Business Entities
  - Are important to an organization
  - They are the essence of the organization
  - The organization will need to keep a track of these business entities
- Examples
  - Pharmaceuticals: Drug Compound, Clinical Trial
  - Archiving organization: Artifact,
  - University: Programme, Module, Student Registration
- Can use standard domain modelling techniques
  - Object modelling and methods
- Units of Work concern Core Business Entities which are dealt by Case Processes

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## Determine Process Modelling Purpose

- Importance of understanding why we are modelling
  - As Is modelling: Tends to be concrete: “Complete Form 21b”
  - Abstract modelling: “Prepare Sales Return”
  - Design for new process
    - For a new system
    - A new unidentified process
  - Modelling for Improvement
    - Compound purposes – combined from above



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## Design for New Process

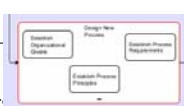
- Before you begin the modelling
- Understand Organizational Givens
  - Org Structures – that must be obeyed
    - University governance
  - IS/IT constraints – existing systems
  - Regulatory requirements (QAA for example)
- Establish Process principles
  - What the process should be like
- Establish Process requirements
  - What must be captured



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## Design for New Process

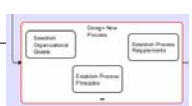
- Establish process requirements
  - What must be captured about a process
  - The starting event or trigger
  - The actions / activities that are required to deal with the event
  - Business rules that govern how the actions are to be carried out
  - Information flows
  - The outcomes of the process
    - Successful outcomes
    - Exceptions



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## Design for New Process

- Establish process principles
  - What the process should be like “its look and feel”
  - Examples
    - Don't bounce external clients between roles
    - Don't keep repeating tasks
    - Have clearly justified timescales and process delays
    - Implement a change management framework
    - Don't request the same information more than once
    - Define manual fallback requirements
    - Roles: Who does what?



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## Conduct Process Workshops

- Workshops are a quick interactive way to get key stakeholders involved early in a project
- Their purpose is to establish:
  - What is the process called?
  - What does it deal with, produce?
  - How does it start?
  - How does it finish? (All outcomes)
  - Who are the people / groups involved?

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## Use Other Sources of Information

- Review / Inspect domain specific documents
  - Outputs (E.g. insurance claim forms, programme specifications)
- Review documents describing documents
  - For COVARM we reviewed the Quality Handbooks at each institution
- Formal meetings and committees (e.g. University governance)
- Interviews
  - With all key stakeholders / users
  - User centred approach

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## Construct Process Model

- Use a Tool Set
- General Guidelines
  - Processes are chronological – orient a diagram along a timeline
  - Ensure all tasks are allocated to roles
  - Consider using UML to describe complex data relationships
  - Use Sub-Processes and Link Events to factor out re-usable behaviour or for structuring
  - Establish standards: Naming, length, style, version management

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## Review, Revise and Re-validate

- Review models internally and with the users
- Revise models and revalidate by checking with users
- When is a model complete?

It isn't!



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## "To Be" Process Modelling Guidelines

- |  |  |
|--|--|
| <ul style="list-style-type: none"> <li>□ Check that all steps are needed                             <ul style="list-style-type: none"> <li>■ Ask why?</li> </ul> </li> <li>□ Review Decision points                             <ul style="list-style-type: none"> <li>■ Are there defined standards?</li> <li>■ Move decision points earlier</li> <li>■ Do you need them?</li> <li>■ Insert time boxes to reduce iterations</li> </ul> </li> <li>□ Cut out the middle man                             <ul style="list-style-type: none"> <li>■ Avoid multiple approvals</li> </ul> </li> <li>□ Redesign data forms                             <ul style="list-style-type: none"> <li>■ Aggregate entry information</li> <li>■ UI guidelines for forms</li> </ul> </li> <li>□ Better to do Domain Model</li> </ul> | <ul style="list-style-type: none"> <li>□ Review Inter-process interactions                             <ul style="list-style-type: none"> <li>■ Analyse handoffs between roles, departments and individuals</li> </ul> </li> <li>□ Automate repetitive steps</li> <li>□ Review cycle times                             <ul style="list-style-type: none"> <li>■ Identify activities that take a long time</li> <li>■ Try and reduce the cycle time for these activities</li> </ul> </li> <li>□ Look for Parallelism                             <ul style="list-style-type: none"> <li>■ Review opportunities for doing work in parallel</li> <li>■ Consider training opportunities</li> </ul> </li> </ul> |
|--|--|

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## Common issues: business process modelling

- Managing collaborative activities within business process models that are derived from the "transformational" approach
- Canonical models and variability management
- Notations are stabilising but methods are lagging
- Process decomposition
  - Some rules available, methodology dependent
  - Becomes more important when coupled with Business process execution and Web Services
- Managing requirements from business processes, to use cases to systems
  - Is the use case driven approach still needed? (non question)
- IT enablement focus – Human Interaction Management tends to be relegated to forms driven approaches

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## Canonical business process models

- ❑ Well-defined, narrowly scoped business domains can choose to agree a business process definition
- ❑ There will always be a need for variations from the canonical model
- ❑ The issue is how to manage standard models and their variations within a single model
- ❑ The JISC funded COVARM project presented an approach to variability management

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### Exercise 3: An assessment design process

- ❑ Consult the case study material
- ❑ Working in groups of three or as pairs produce a process diagram using the BPMN notation
- ❑ How could you improve the process to make it more efficient?
- ❑ How would you change the process to allow it to deal with assessments that have been through the scrutiny process and have only been changed slightly?

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## Review of Exercise 3

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## Session 4: General Issues

- ❑ Business Activity Monitoring (BAM)
- ❑ Activity Based Costing (ABC)
- ❑ Process Modelling and the JISC e-Framework
- ❑ Domain maps – the new reference models
- ❑ Tool Support for BPMN
- ❑ Summary
- ❑ Next steps

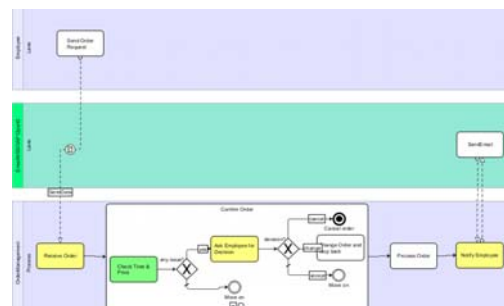
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## Process Modelling –MDA Viewpoint

- Platform independent Models
- Platform specific models

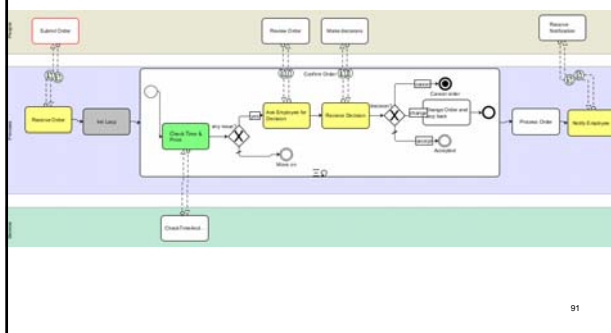
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### Platform independent model



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## Platform specific model



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## Business Activity Monitoring

- BAM refers to the aggregation, analysis, and presentation of relevant and timely information about business activities inside organizations and involving customers and partners.
- BAM provides more accurate information about the status and results of various operations processes, and transactions so business decisions can be informed, quickly address problem areas and reposition organizations to take full advantage of emerging opportunities.

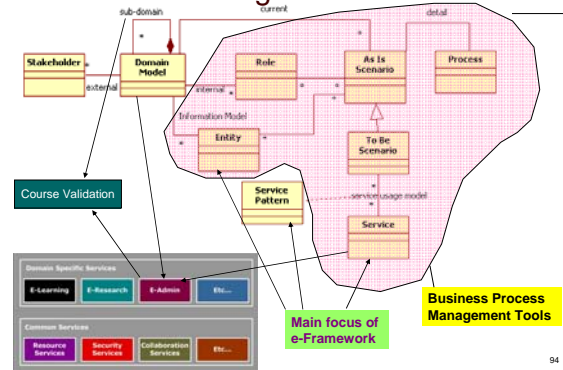
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## Activity Based Costing

- Associate cost to each process task
- Monitor process execution to identify value add and efficiency
- Re-design processes to reduce cost

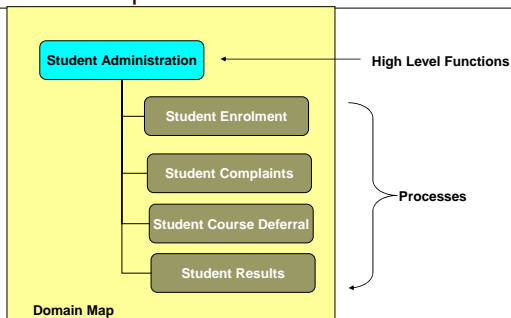
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## Process Modelling and e-Framework



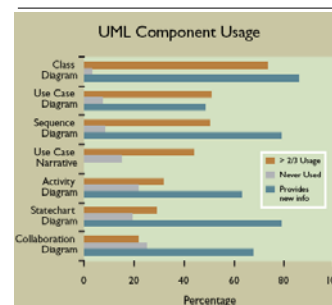
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## Domain Maps – Functions and Processes



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## Process vs Use Case



From: Dobing and Parsons (2006)

- Activity Diagrams provide more new info than use cases
- Use Case Narratives are used but provide no new information

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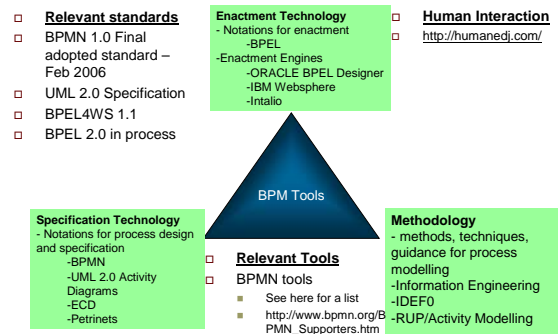


## e-Framework Key Points

- Process modelling is important for SOA (and soa?)
- There is a new wave of technologies - toolsets and notations
  - (model driven) business process management
- Processes are central to understanding and developing domains but are not sufficiently represented in the e-Framework
- Process modelling needs to be part of a method framework to ensure that design and development is streamlined
  - E.g. overlap between process modelling and use case modelling

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## Tools, Technologies and Standards

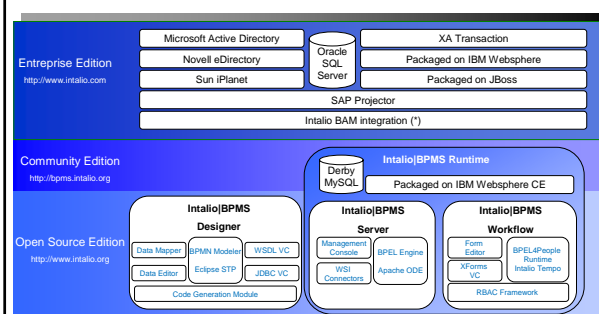


## Tool Support

- There are currently 42 implementations of BPMN (and 4 planned)
  - A complete list is available at: [http://www.bpmn.org/BPMN\\_Supporters.htm](http://www.bpmn.org/BPMN_Supporters.htm)
- There are at least three open source (freely downloadable community editions)
  - **Intalio: n³ Designer™**
    - [www.intalio.com](http://www.intalio.com)
    - Has been used in the production of diagrams for this workshop
  - **Soyatec: eBPMN Designer**
    - [www.soyatec.com](http://www.soyatec.com)
    - Also has UML 2.0 compliant toolset

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## Intalio|BPMS: Several Editions



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## Demonstration of Intalio Designer

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## Workshop Summary

- This workshop covered:
- Process modelling principles
- BPMN basic concepts to get started
- A lightweight process modelling methodology
- An overview of other approaches to process modelling from JISC projects

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## Next?

- Follow on workshop topics:
  - Construct BPMN models using a toolset such as Intalio Designer
  - Guidelines on using Toolsets
  - Simple Implementation / Execution using BPEL

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## Follow these JISC projects!

- COVa
  - Implementation of Course Validation Scenarios from the JISC COVARM project using a BPMN Platform
  - Likely to be Intalio
  - Will use consume existing COVARM WSDL Services
  - Will use other low-level services such as Calendaring
- P-SPEX
  - Exploration of Course Management domain
    - Lifecycles of courses and their evolution
- Further info from:
  - [Balbir.Barn@tvu.ac.uk](mailto:Balbir.Barn@tvu.ac.uk)

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## Useful References

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- Peter Fingar et al. *Extreme Competition: Innovation And the Great 21st Century Business Reformation*. ISBN 0-929652-38-X
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- Thanks to:
  - Mahendra Mahey, UKOLN
- Some of the slides have been adapted from OMG public source material available at the OMG website for BPMN
  - [www.bpmn.org](http://www.bpmn.org)
- Methodology adopted from Ould 2004
- Remember: Please complete the evaluation form!

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