



ER - Data-centric business process modeling

Learning Goals

1. Know what a data-centric business process model is
2. Understand the advantages of data-centric BPM vs process-centric BPM
3. Model a data-centric BPM using UML (OCL)

The importance of models



No plans...

- And one water pipe broke!
 - Turned out to be one of the heating pipes
 - I had no clue where the pipes were

Data-centric Business Process Models

Data-centric Business Process Models



- Realize organization's goals
- Key to the success of a company

- NEW approach
- Focus on data

- Facilitate communication
- Provide a basis for process improvement
- Facilitate process management

Perspectives on BPM

[Curtis, Kellner, Over 1992]

FUNCTIONAL.

What is performed and flow of entities

BEHAVIOURAL.

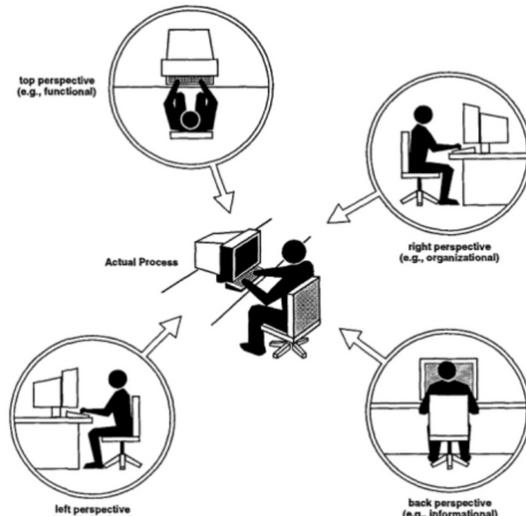
When process elements are performed and how

ORGANIZATIONAL.

Where and by whom they are performed

INFORMATIONAL.

Information entities produced and manipulated;
their structure and their relationships.



Process-centric BPM

- Focus on the sequencing of activities
→ Behavioral perspective

Data-centric BPM

- Focus on the data and details of tasks → Closer to functional, behavioral, informational perspectives

BALSA Framework

What is exactly a data-centric BPM?



BALSA Framework

- Defined by [Hull 2008]
- 4 dimensions that should be present in data-centric BPM

> Dimensions

Business Artifacts.

```
// artefacte = subconjunt del  
model de dades. Informació  
necessària per a entendre el  
sistema.
```

def. Relevant data for businesses

- Attributes
- Identifier (they can be distinguished)
- Relationships to other artifacts

Lifecycles.

```
// lifecycle = estats pels quals que  
passa un artefacte al llarg de la vida  
del sistema.
```

def. Relevant stages in the evolution of an artifact

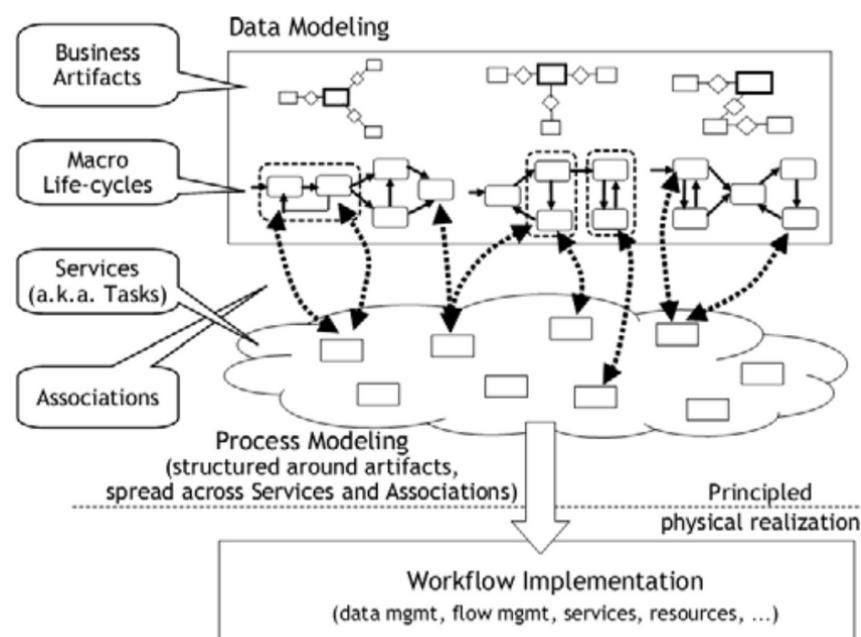
Services.

def. Create, update, delete business artifacts

Associations.

def. Establish restrictions over the execution of services

[Hull 2008]



Data-centric BPM in UML

BALSA Framework

- *Business Artifacts*
 - Relevant data for businesses
- *Lifecycles*
 - Of the business artifacts
- *Services*
 - Meaningful unit of work
 - Create, update, delete artifacts
- *Associations*
 - Links between services

UML / OCL

- Class Diagram
- State Machine Diagram
- OCL Operation Contracts
- Activity Diagrams

> Why a notation based on UML/OCL?

- UML
 - Graphic representation of specification of systems
- Representation of dynamic and static aspects
 - Widely used & flexible
 - It has a precise semantics
 - ISO/IEC Standard (ISO/IEC 19505)
- Complemented by OCL
 - Declarative language, with a precise semantics
 - ISO/IEC Standard (ISO/IEC 19507)

> Running Example

bicing



City bicycle rental system

- Alternative form of public transportation
- Several bicycle stations placed around the city
- Users take bicycles from stations and drop them off at other stations

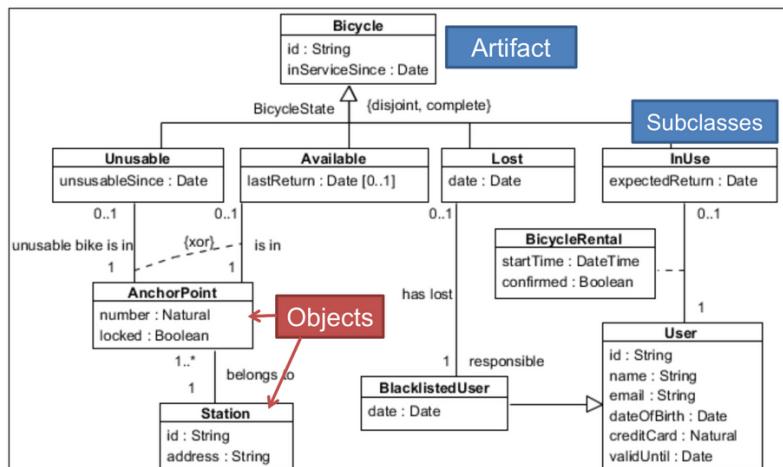
We assume

- We wish to track bicycles and their evolution
- Who is using them
- Where they are, if they are not in use

Simple system

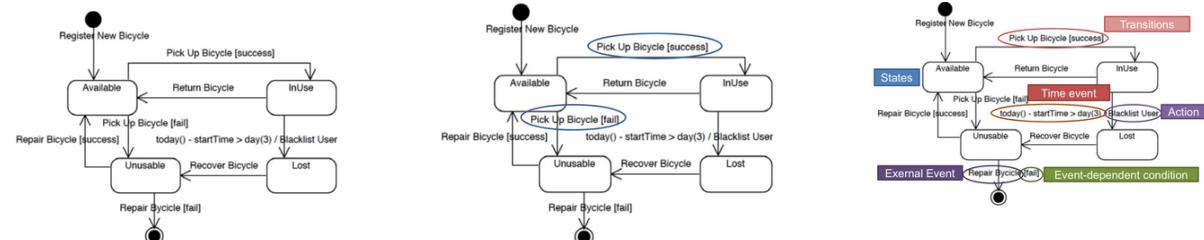
- No history of bicycle rentals

BAUML: Business Artifacts

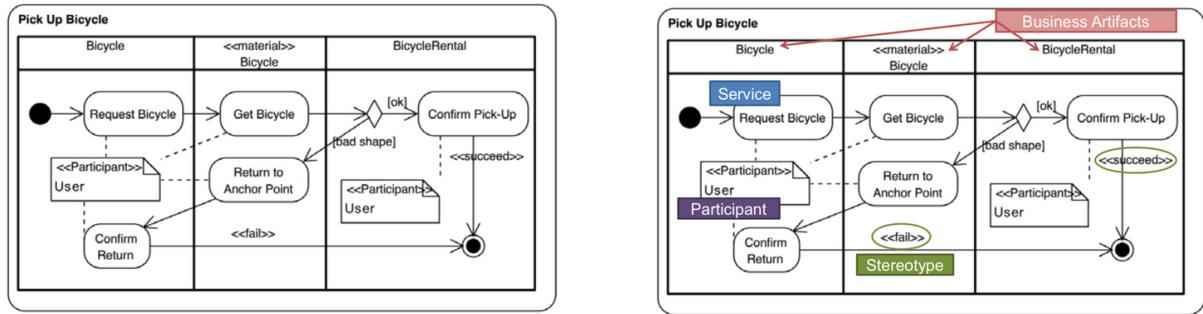


- Identity
- OCL constraints
- Attributes
- Relationships

Lifecycle.



Associations.

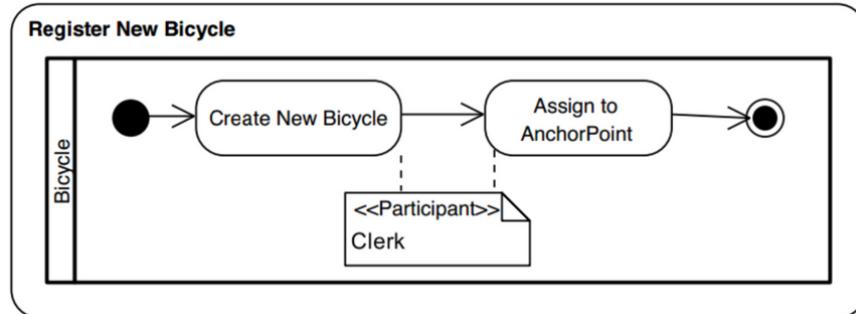


Services.

Represented in OCL Operation Contracts

- Signature: Op. name, input parameters, output
- **Precondition:** Conditions that must be true in order for the service to execute (i.e. *before* execution)
- **Postcondition:** Conditions that are met *after* the execution of the service

Alternatively, a set of structural events may be used



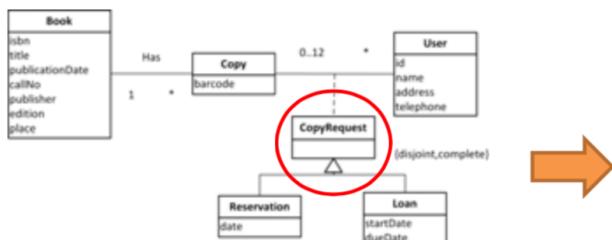
```

operation
  CreateNewBicycle (bId: String): Bicycle
localPre:
  -
localPost:
  Bicycle.allInstances()-> exists
  ( b |
    b.oclIsNew( ) and
    b.id=bId and
    b.oclIsTypeOf(Available) and
    b.inServiceSince = today() and
    result=b
  )

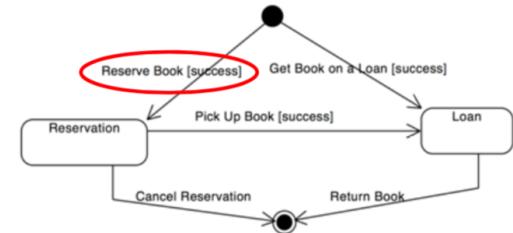
operation
  AssignToAnchorPoint (b: Bicycle , apNumber: Integer , stationId: String)
localPre:
  -
localPost:
  b.oclAsType(Available).anchorPoint =
  AnchorPoint().allInstances()->select
  ( ap |
    ap.number=apNumber and
    ap.station.id=stationId
  )

```

The whole picture.



Business Artifacts



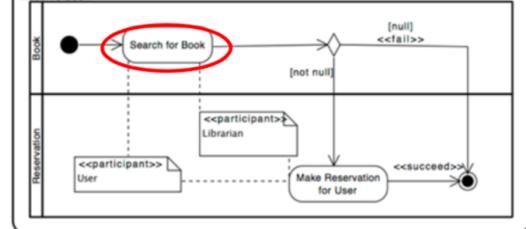
Lifecycles

```

action MakeReservationForUser (uid:String, bc:String)
localPre: -
localPost:
  Reservation.allInstances() -> select(r | r.oclIsNew()
  and r.user.id=uid and r.copy.barcode=bc)

```

Services



Associations

Potential of Data-centric BPM

> Practical Uses of Data-Centric BPM

What can we do with these models?

Detect errors before the process is deployed

- Automatic reasoning

Detect deviations once the process is running

- Process conformance techniques

> Semantic Reasoning on Data-Centric BPM

Automatic reasoning:

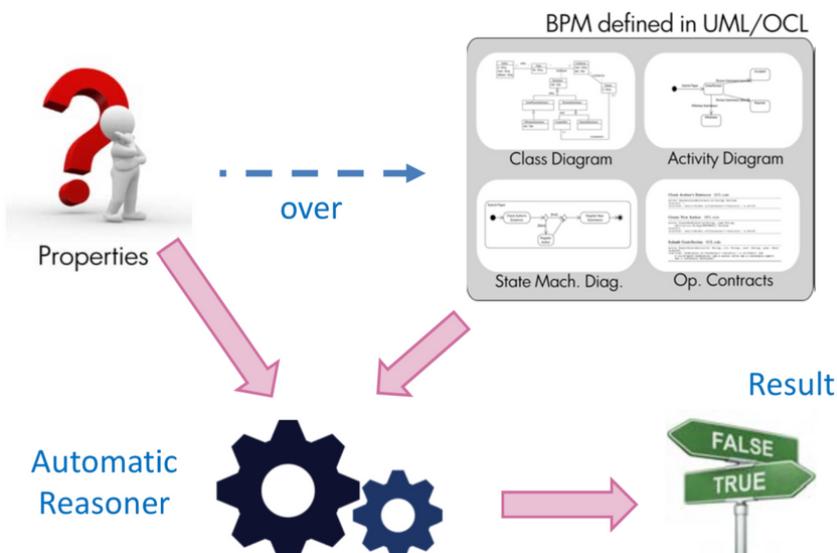
Syntactic correctness

- This can be done on process - centric BPMs

Semantic correctness

- Thanks to the data
- Verification: Is the *model right?*
- Validation: Is it the *right model?*

Overview of (Semantic) Automatic Reasoning



> Process Conformance with Data-Centric BPM

We can apply process conformance techniques that consider data to detect deviations at run-time

What do we achieve?

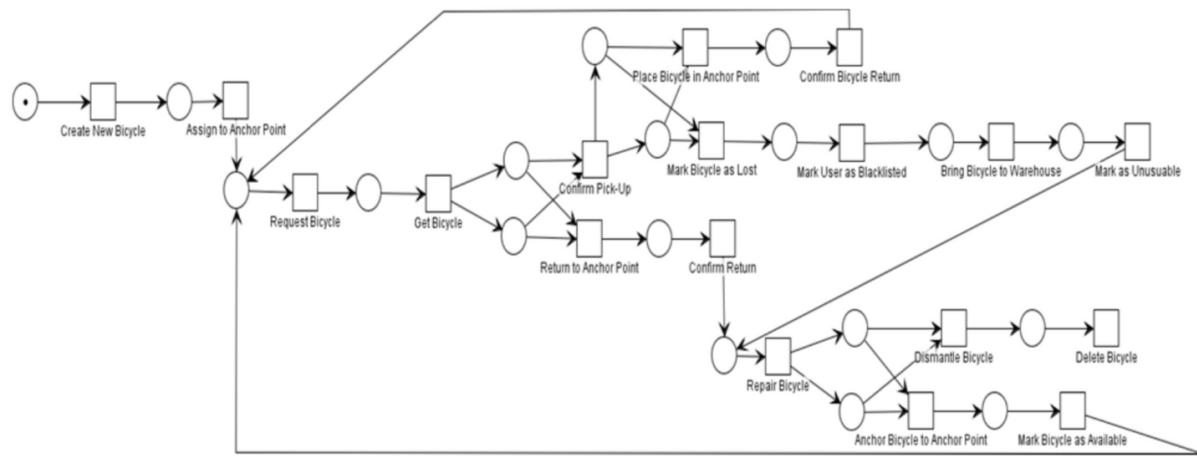
Given a log ("reality"), check how far the real behaviour of the proces is from the one defined by the model

How do we do it?

Translate our BPM-UML model into a Petri Net

Reuse existing tools to perform conformance checks

Deviations: Petri Net of our example



> Approach Appealing for Industry

BALSA Framework

- **Business Artifacts**

Relevant data for businesses

- **Lifecycles**

Of the business artifacts

- **Services**

Meaningful unit of work

Create, update, delete artifacts

- **Associations**

Links between services

New ideas after industry

- **Class Diagram**

- **State Machine Diagram**

States derived through views

- **OCL Operation Contracts**

enable actions

trigger automatic responses

