Faculty of Sciences,
Technology
and Communication

Specifying Executable Platform-Independent Models using OCL

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The Problem

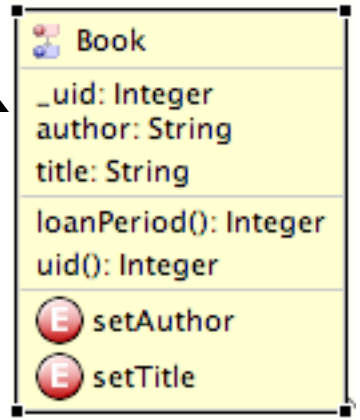
- Vision of Model-Driven Architecture
  - Full code generation from models
  - Models become real assets
- Requires precise and complete description of a system using models
  - Structure and behavior of the system need to be described
  - How?

The Structure

- Static structure of the system can be conveniently described using UML
  - UML is a standard (current version 2.0)
  - Although full specification is large and complex, we only need to use a small part
  - Use class diagrams for describing the static structure

Class Diagrams

- In class diagram
  - Define initial values of properties using OCL “init” constraint
  - List as operations only query operations; body defined using OCL “body” constraints
  - Add compartment with events -> modifier operations (formal definition using UML profile)



The Behavior

- Could also use UML for behavior
- However: UML behavioral diagrams describe behavior only partially
- Option 1:
  - Augment UML behavioral diagrams with action language based on UML Action Semantics

    Drawback: action languages are imperative in style: clash with declarative style of diagrams

The Behavior (2)

- Option 2:
  - Define semantics of operation using OCL pre- and post-conditions

  Drawback: precise but not executable; not suitable for full code generation
- Option 3:
  - Describe behavior using another

    MOF-based metamodel

The EP-Language

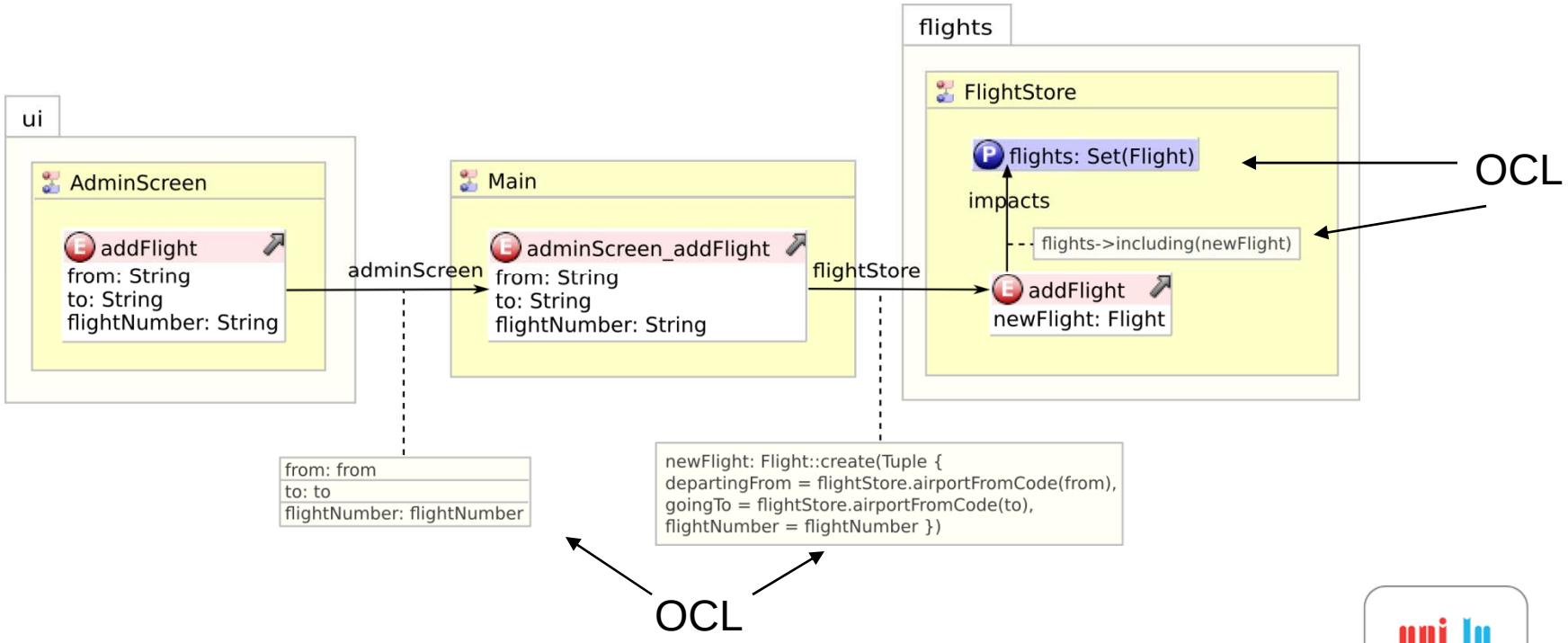
- Recall that events in class diagram represent modifier operations
- Event can impact (modify) a property and can have child events
- Event may have parameters
- Parameters of child event expressed in terms of parameters of parent event

The EP-Language (2)

- When an Event impacts a Property, we associate a function that computes the new value with the impacts link
- With each parameter of an event and each incoming link from a parent event, associate a function that computes the value of the parameter
- These functions are side-effect free and are expressed as OCL-expressions

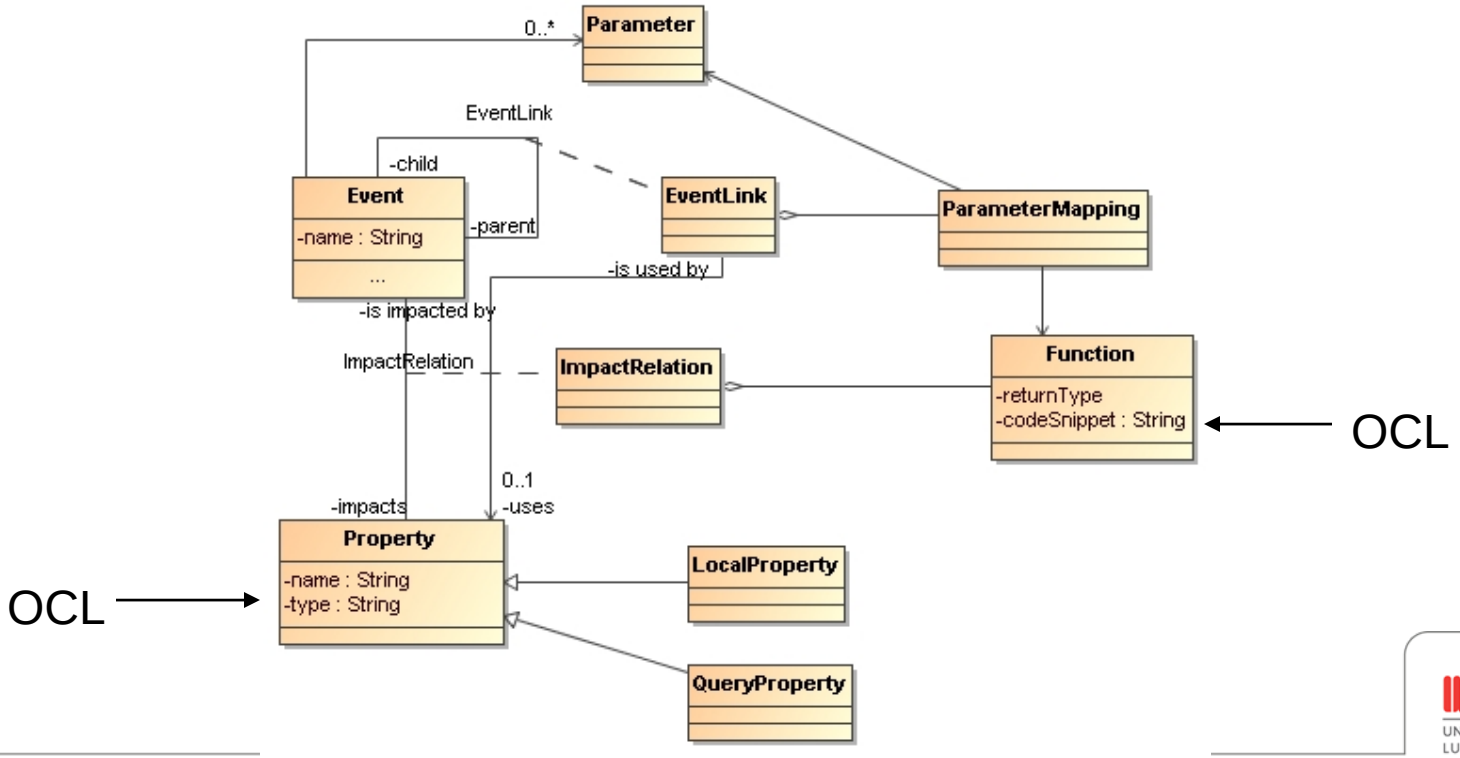
An Example

- Event tree in Flight Reservation System



The EP Metamodel

- Metamodel of the EP-language

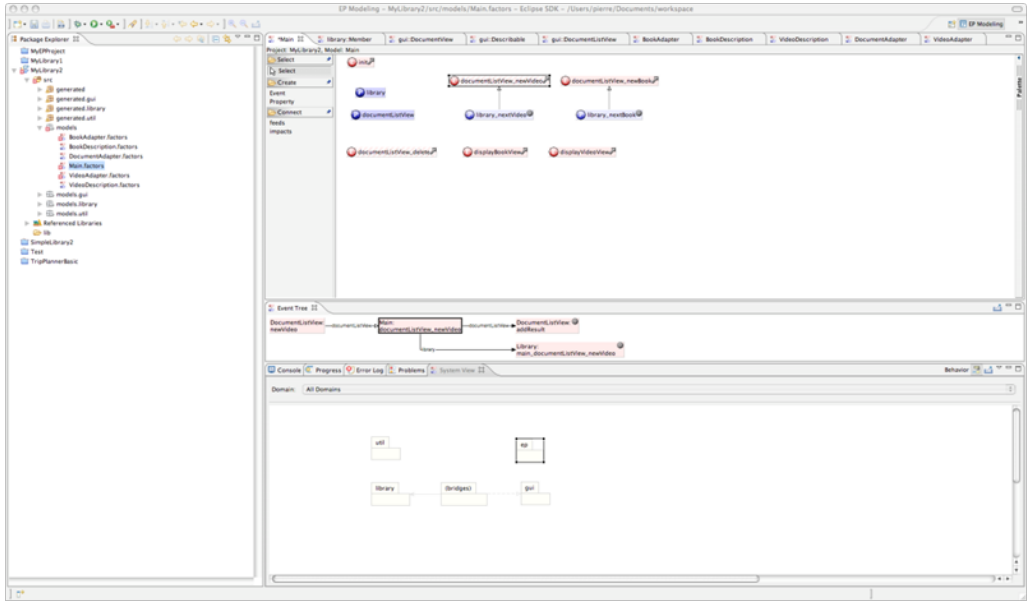


Why OCL?

- We need a language with the following properties
  - Describes side-effect free functions (-> EP metamodel)
  - Platform-independent (to describe PIMs)
  - Allows object navigation
  - Turing-complete
- OCL satisfies all these requirements

Tool Support

- Advantage of OCL: wide-spread tool support, e.g., in Eclipse
- Democles tool



What's missing?

- OCL not originally intended as a "programming language"
- Missing features
  - Missing built-in types, e.g., Date
  - Built-in types are lacking basic operations (even needed for constraints), e.g.,
    - is a String a substring of another String
    - convert String to Integer
  - Object creation

Conclusion

- OCL can be used for precise behavioral modeling
- Expresses side-effect free functions within EP-models
- OCL needs to be extended to describe realistic systems

Questions

- Questions?