Object Constraint Language (OCL)

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Why Is It Needed?
- Graphics model not descriptive enough
- Natural Language leads to ambiguity

Why OCL?
- Less Mathematical than other languages
- Allows more content to be added to the basic UML
- Makes the model:
  - Precise
  - Consistent
  - Complete

Object Constraint Language (OCL)

What is OCL?
- Means of extending the UML
- Allows us to specify 4 Types of constraints on an object:
  - An Invariant, a post condition, a pre-condition and a guard (more on those later)

Expression Language

Modelling Language

Formal Language

Properties of OCL?
- Expression:
  - Guaranteed to occur without side effect
  - Cannot change the model in any way
  - Just evaluates and returns a value

Modelling:
- Not programming
- Not possible to define a logical flow
- An expression cannot change the state of the system

Formal:
- All constructs are defined
- Only 1 unique reading of the
- Expression possible

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< 55 SECOND VIDEO CLIP TO GO IN HERE – ATTACHING IT WOULD HAVE MADE THE FILE TOO LARGE. VIDEO CLIP IS FROM KNIGHT RIDER THE GAME, AND THIS WILL BE USED FOR EXAMPLES DURING THE PRESENTATION >
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Types of Constraints:
- Invariant
  - Constraint that applies to ALL instances of class (or type or interface)
  - An expression that evaluates to true if the condition is met.
  - All Invariants must ALWAYS evaluate to true.

Precondition
- Must be true at the moment the operation is to be executed.

Post Condition
- Evaluate to true at the moment the operation ends

Guard
- Must be true before state transition can occur

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Invariant on Attributes:
- Constraint: DRIVER MUST BE OVER 18
- Context KittDriver inv:
  - Age >= 18
- Context KittDriver inv:
  - Height >= 150

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Invariant on Associations
- Constraint can be placed on attributes that are connected over associations

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Invariant on Collections:
- Many associations are not 1 to 1.
- To deal with this we treat them as collections and apply
  SET OPERATIONS
  - includes (object) – for membership test
  - union (set of objects)
  - intersection (set of objects)
  - notEmpty (set of objects)

LOGIC OPERATIONS
  - Exists, forAll
  - XOR, AND,
  - ∀ Weapons (∃ WeaponController)

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Context
- Need to specify which item from the model it’s a constraint on
- Usually a group of UML diagrams
- For an invariant the constraint applies to all instances of that class or type or interface
- The keyword “self” is used to specify the context of the constraint

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Guards

- The UML contains **STATE TRANSITION DIAGRAMS**

- Guards specify conditions that need to be met before a transition can occur

- Evaluated before the transition so can be thought of as a pre-condition

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Guards

- PursuitMode
- NormalMode

 Indicates that pursuit mode can only be engaged when self.Operational is true. This is an example of a guard.

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Constraints and Inheritance

- Subclass can strengthen constraint but not relax it

- Encapsulation and abstraction

- Increase down inheritance hierarchy

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Broken Constraints

- What to do if constraint is broken is not specified

- OCL is only a modelling language

- Action cannot be carried out as a result

- Kleppe and Warmer proposed including ACTIONS in OCL at the UML 2000 conference.

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Further Reading

- Big area, a whole formal language

- Area of research and development

- Submission been made for OCL 2.0 as part of UML 2.0

- Look at book for more information

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Summary

- Adding constraints allows us to express more in an object model

- OCL provides a formal, non-ambiguous way of doing this

- Invariants, Pre Condition, Post Condition and Guards are employed

- Extensions to these are being worked on

- OCL 2.0 part of UML 2.0