A Solution based on the FMMLx

The MULTI 2018 Bicycle Challenge

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Instead of a Multi-Level Modelling Method

- outline scope and purpose of the model(ling language)
- free yourself from the traditional idea of a clear borderline between models and modelling languages
- specify the knowledge you gain about domain on highest level possible
- if needed, divide domain in subdomains ("possible worlds")
- to not compromise flexibility, try to make sure that "classification" is invariant
- avoid "pseudo" instantiation
- take your time reflecting upon the semantics of your model
FMML*: Notation Overview

MetaClass

^MetaClass^
PeripheralDevice

name: String
1 salesPrice: Float
0 serialNo: String
0 partSalesPrice: Money
totalRevenues(): Money
models(): Integer
1 totalUnitsInStock(): Integer
1 revenues(): Money
intrinsic operation, instantiated in classes on M₁

^PeripheralDevice^
Printer

name: String
pagePerMinute: Integer
resolution: Integer
1 salesPrice: Money
0 serialNo: String
0 partSalesPrice: Money
revenues(): Money
totalUnitsInStock(): Integer
salesPrice = \text{false}
\text{race} = \text{true}
totalRevenues() = €7399.00
models() = 13
intrinsic attribute, instantiated in objects on M₀

^OrganizationalUnit^
Position

n\text{responsible for}
0,*
1,1
n\text{uses}
0
^MetaClass^
PeripheralDevice

\text{skillLevel}: \text{Score}
\text{minAvailability}: \text{Score}
\text{costPerMin}: \text{Float}
averageAvailability(): Duration
\text{intrinsic association, instantiated between objects on M₀}

M₁

^Printer^
CPL-844

0 serialNo: String
0 partSalesPrice: Money
pagePerMinute = \text{40}
resolution = \text{600}
salesPrice = \text{199.00}
object returned by operation

M₂

M₃

object state
Generic Domain: Configuration

```java
class Configuration {
    String name;
    Float weight;
    Component[] components;
    float totalRevenues() {
        return ...;
    }
}
```

**Component** class:
- name: String
- weight: Float
- ofInstance: int
- ofType: int
- ofInstance(): int
- ofType(): int
- composable: boolean

**Part** class:
- name: String
- ofType: int

**CompPart** class:
- name: String
- ofType: int

`M_5`
Textbook Knowledge about Bicycle Configurations

^Configuration^ Bicycle
- allTerrain: Boolean
- race: Boolean
- material: Material
- color: ...
- weight: Float
- salesPrice: Float
- partSalesPrice: Float
- serialNo: String
- highestPrice() : Float
- getFrontWheel() : Wheel
- getBackWheel() : Wheel
- averagePrice() : Float
- totalRevenues() : Float
- averageActPrice() : Float
- topSeller() : Bicycle

^Part^ Frame
- allTerrain: Boolean
- race: Boolean
- material: Material
- color: Color
- height: Float
- weight: Float
- serialNo: String

^Part^ Fork
- suspension: Boolean
- color: Color
- material: Material
- weight: Float
- serialNo: String
- mudMount: Boolean

^Part^ Wheel
- safetyRefl: Boolean
- material: Material
- size: Float
- width: Float
- weight: Float
- tubeless: Boolean
- serialNo: String
.. Or rather “ElectricBike” as a metaclass?
Other Aspects (1): Customers

^MetaClass^ Person
0 firstName: String
0 lastName: String
0 dateOfBirth: Date
0 sex: Gender
0 vatLiable: Boolean
0 age(): Integer

^MetaClass^ Organisation
0 name: String
0 size: Integer
public: Boolean
legalForm: LegalForm

^MetaClass^ NotLiableFemale
0 lastName: String
0 firstName: String
0 dateOfBirth: Date
0 age(): Integer
sex = [female]
vatLiable = [false]

^MetaClass^ LiableMale
0 lastName: String
0 firstName: String
0 dateOfBirth: Date
0 age(): Integer
sex = [male]
vatLiable = [true]

^NotLiableFemale^ #134123
lastName = Storm
firstName = Susan
dateOfBirth = 1977-10-05
age(): 39

^Person^ role_of 1,1

^Organisation^ LimitedCompany
public = [false]
legalForm = [limited]

^Organisation^ PrivateCustomer
id: String
firstPurchase: Date
private = [true]

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Other Aspects (2): Invoicing
FMML* in the XModeler

https://www.wi-inf.uni-duisburg-essen.de/LE4MM/
Final Remarks

- Bicycle Challenge very useful exercise
  - contribution to clarify semantics
  - ... to challenge previous assumptions
  - ... to

- proposed model rather an intermediate step than a mature solution
  - tuned to existing version of the FMMLx
  - no account of adapting the model to different domains, e.g. department store, general bicycle store

- nevertheless suited to demonstrate clear advantages of multi-level modelling

We should continue with the Bicycle Challenge ... and work on further application domains