UML Profiles versus Metamodel extensions : An ongoing debate

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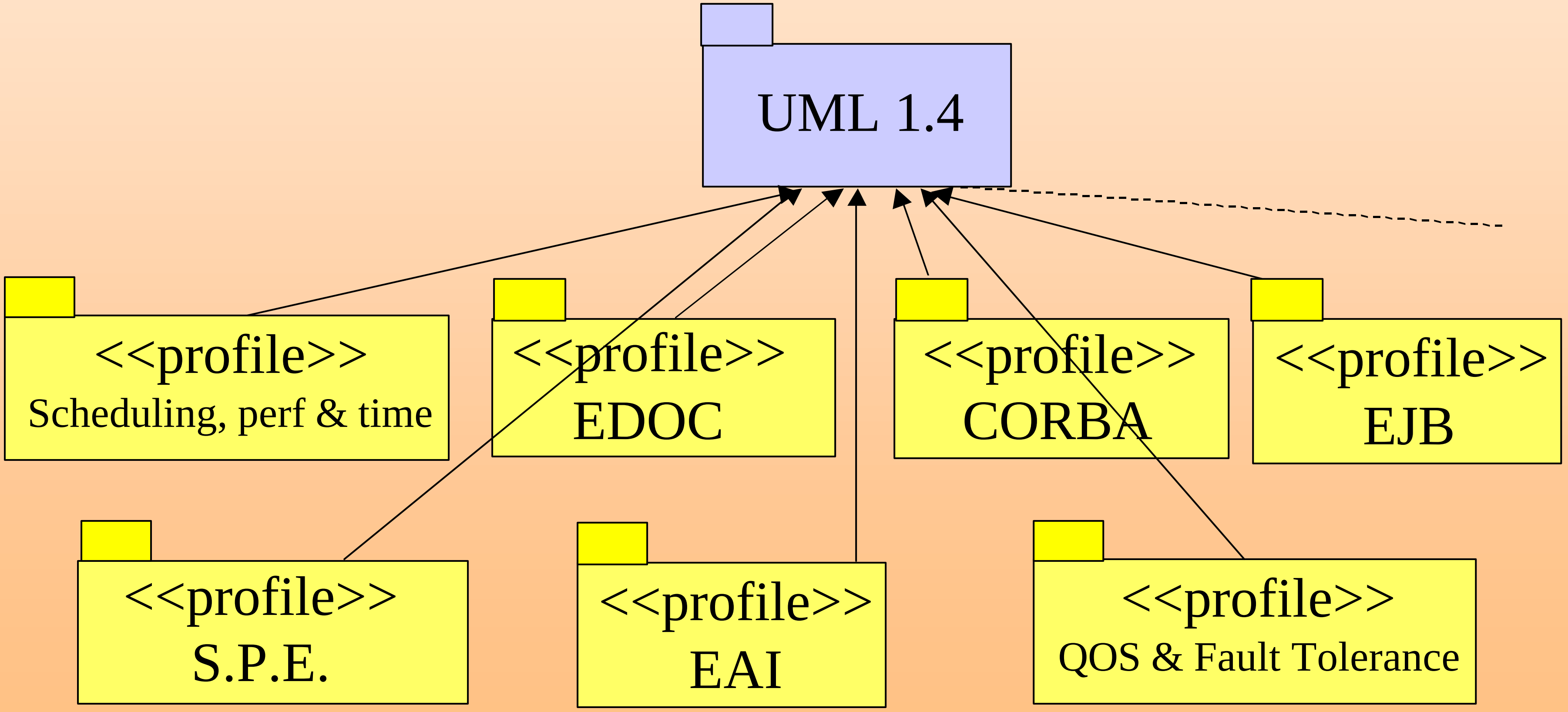
UML 1.4 profiles modeling capacities

- **Structuring the extensions (Profile = Packages)**
- **Defining new meta-classes (Stereotypes)**
- **Defining new meta-attributes (tagged values)**
- **Defining new meta-associations (tagged values, referencing to other model elements)**
- **Defining new constraints**
- **Modeling graphically profiles**

This is almost all we need for defining metamodels

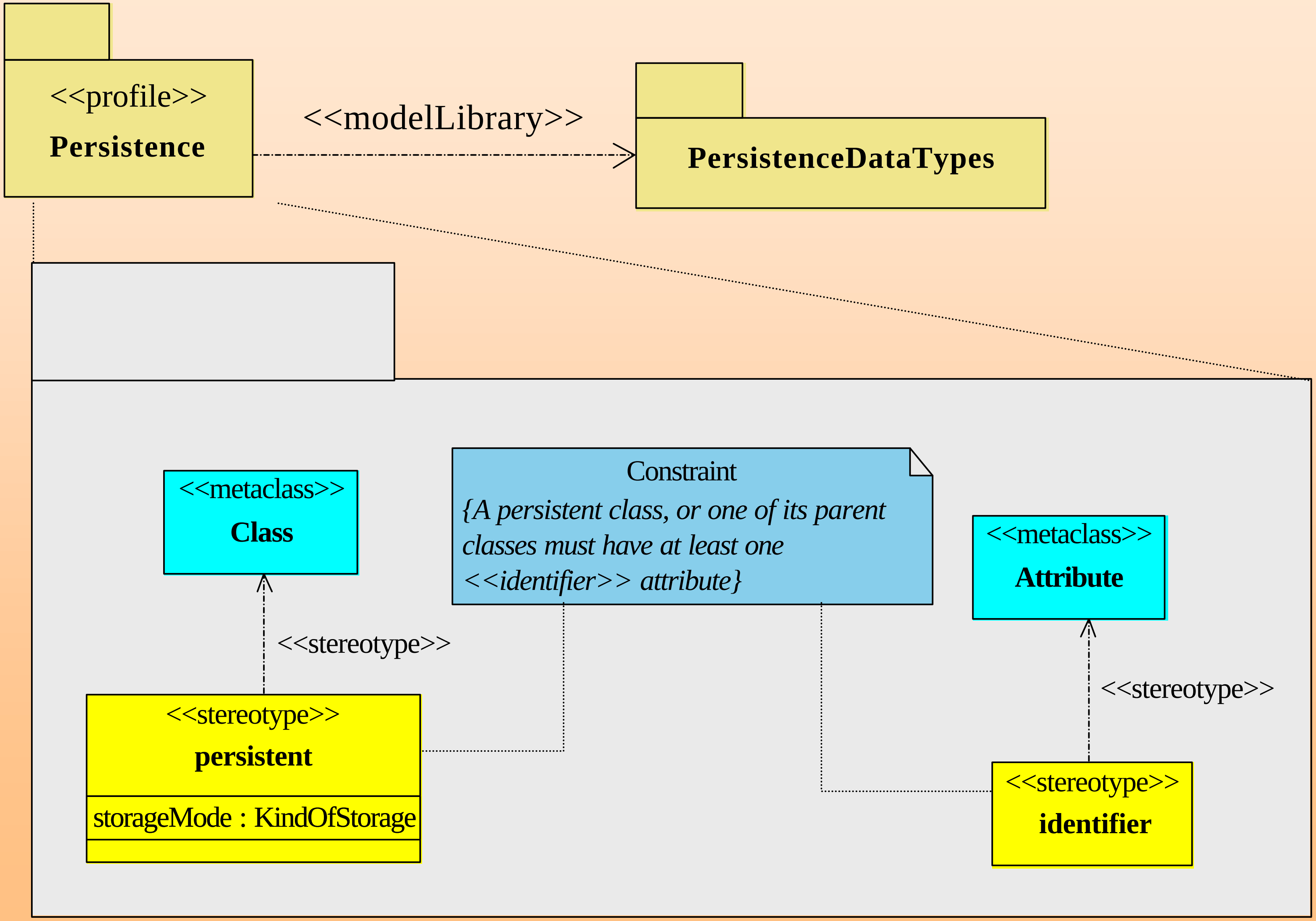
UML Profiles: Adapting UML to each domain

PROFILES STRUCTURE UML EXTENSIONS

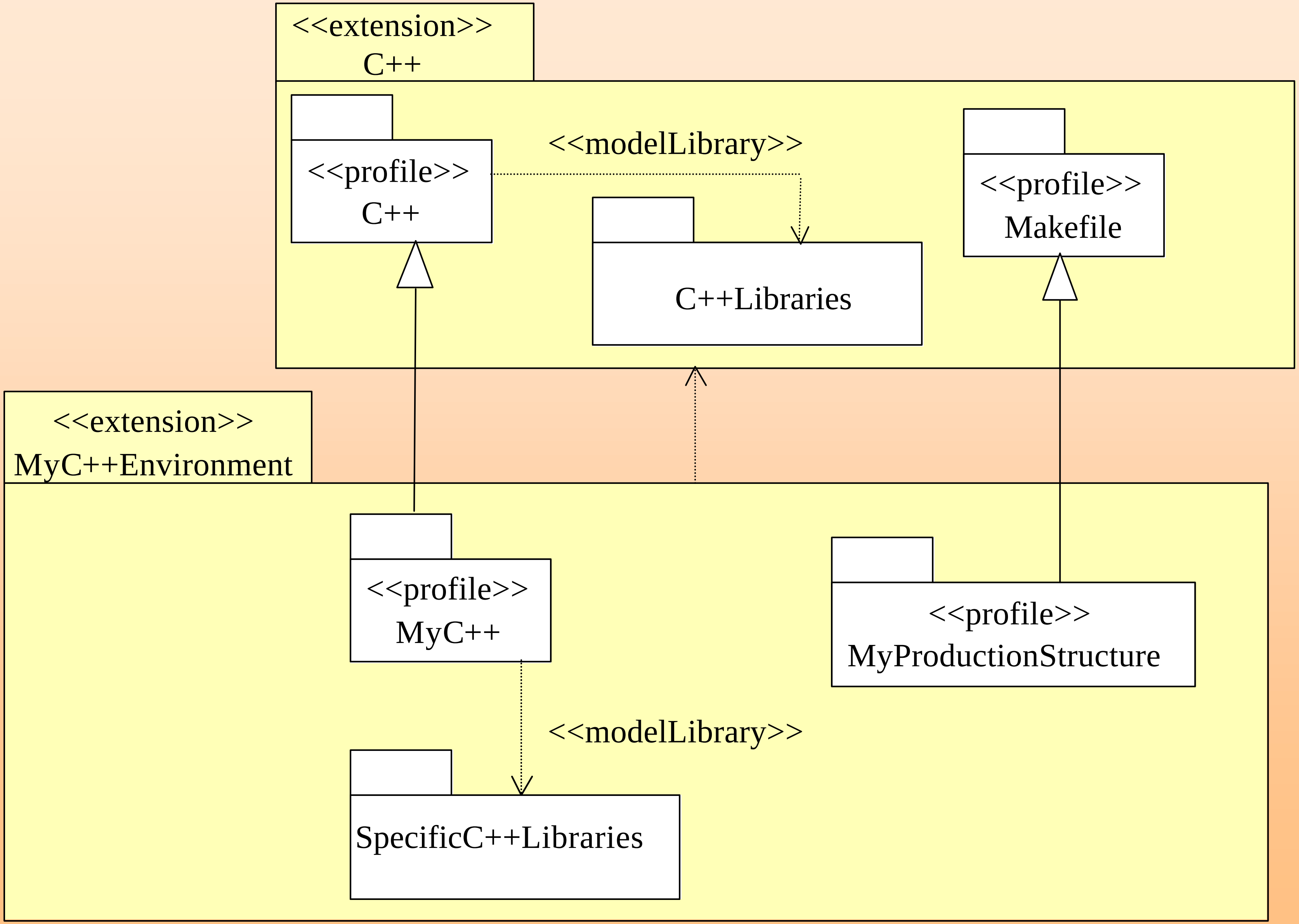


(Software Process Engineering Management)

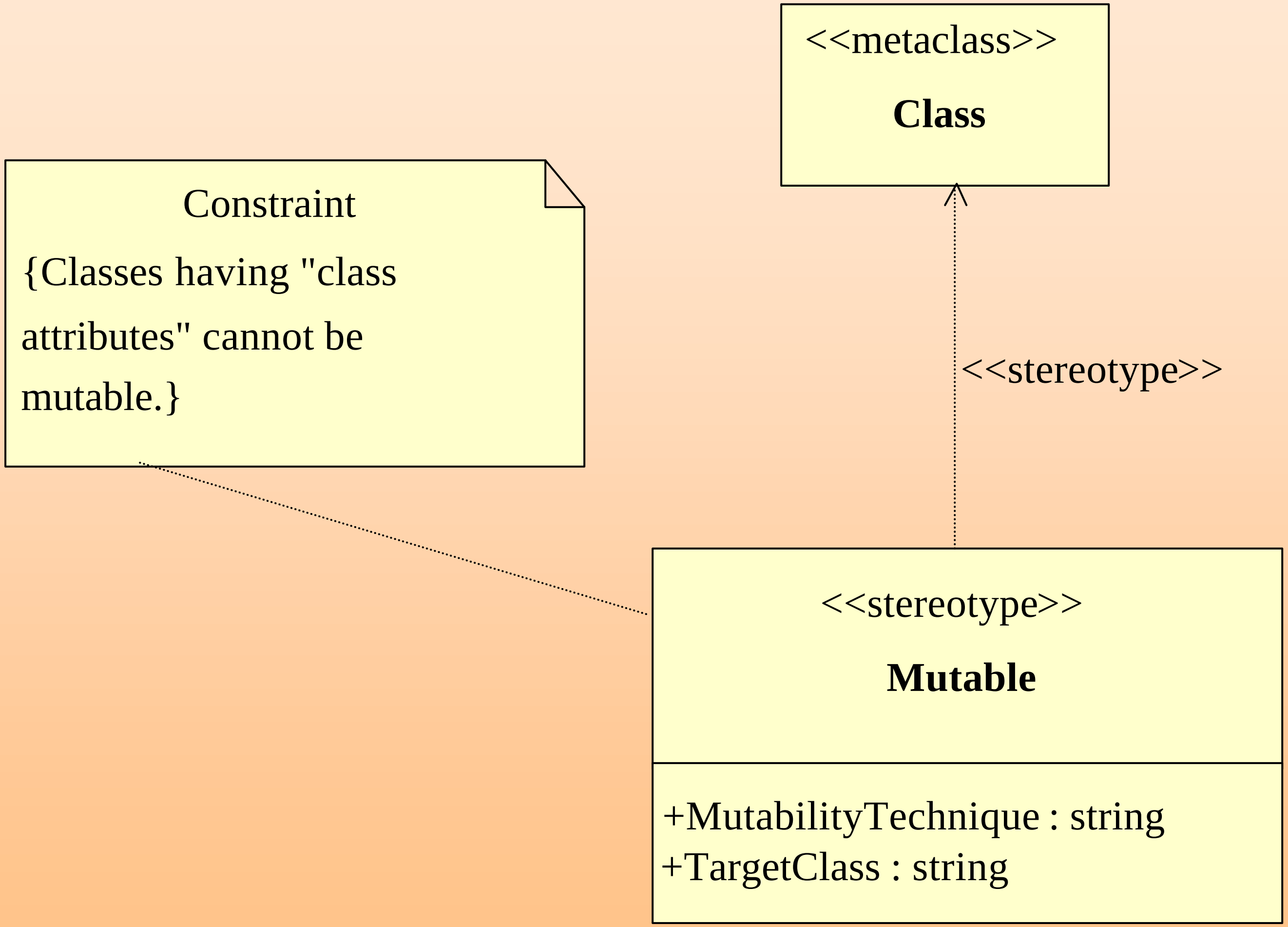
UML Profiles
Model example (1)



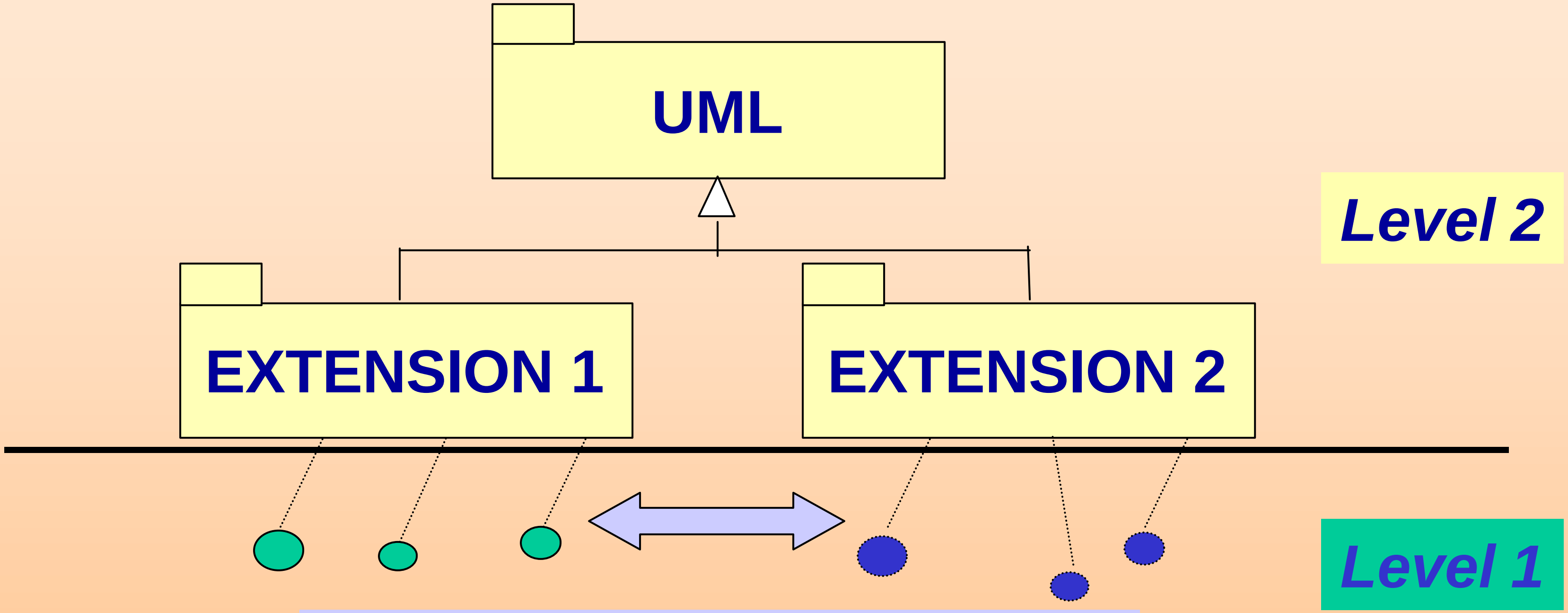
UML Profiles : Model examples (2)



UML Profiles : Model examples (3)



MOF : Model interoperability
A major goal, hard to combine with flexibility



Different instances, very hard to combine or to convert

- Troubles with different versions of UML, becoming even harder when combined with MOF/XMI versions
- Tool implementer testimony : moving from one metamodel to another is a real heavy task, hard for tool implementers, heavy for end users

MOF architecture (implicit) postulates for interoperability

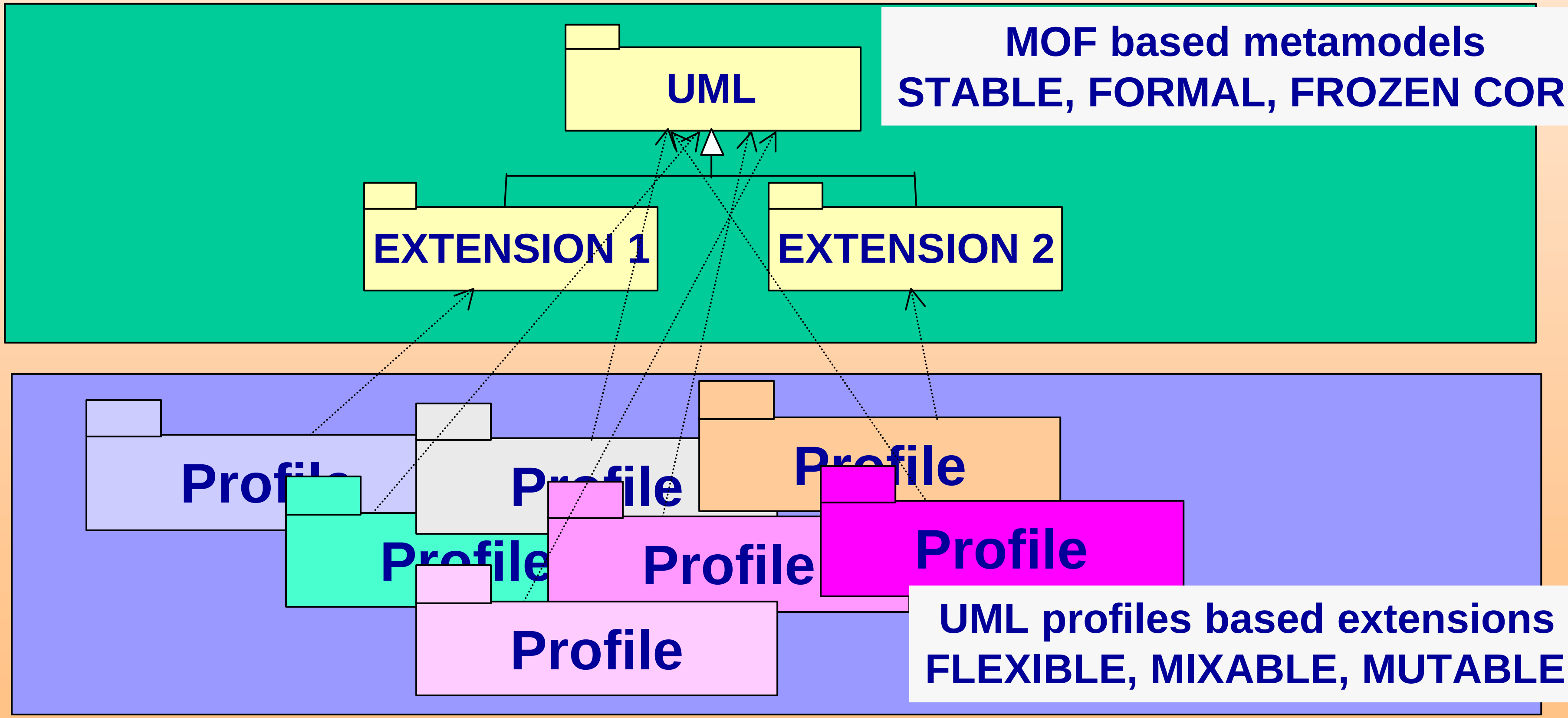
- Metamodels are stable (standardized). They do not evolve, or do change only after a long stable period
- Metamodels are formal : there semantics are completely defined, in a precise and unambiguous way

The reality is :

- We (end users) wish a stable root standard but we never have (yet)
- The extensions that we define are incomplete, informal, and may even be contradictory
- We need flexibility, ability to change fast, to combine different views

A complementary view of MOF and profiles

All at level 2 regarding the MOF architecture



MOF based metamodels
STABLE, FORMAL, FROZEN CORE

UML profiles based extensions
FLEXIBLE, MIXABLE, MUTABLE

UML Profiles Flexibility

- Supporting profile combination : several profiles can be applied to the same model
  - Ex : A class can be *reactive* (real time profile), and *persistent* (RDB profile) at the same time
  - Even inconsistent profiles can be combined (ex : Java and C++)
- Supporting model exchange between different profiles
- Supporting the dynamic change of applied profiles to a model, in order to change perspective during the development lifecycle

UML profiles is a mechanism for defining flexible projections of a stable predefined core metamodel.

UML model elements have an immutable part (their core UML definitions) and mutable combinable extensions

Inherent properties of profiles

- A profile defines a projection of a reference metamodel
- Profiles provide a mechanism to define facets that can be applied to model elements and combined
- All elements defined in a profile are mutable. Mutability rules are driven by the reference metamodel

Rational for choosing the right metamodeling technique

- Your domain is well defined, and has a unique well accepted main set of concepts
- A model realized under your domain is not subject to be transferred into other domains
- There is no need to combine your domain with other domains

➔ Choose a MOF based technique

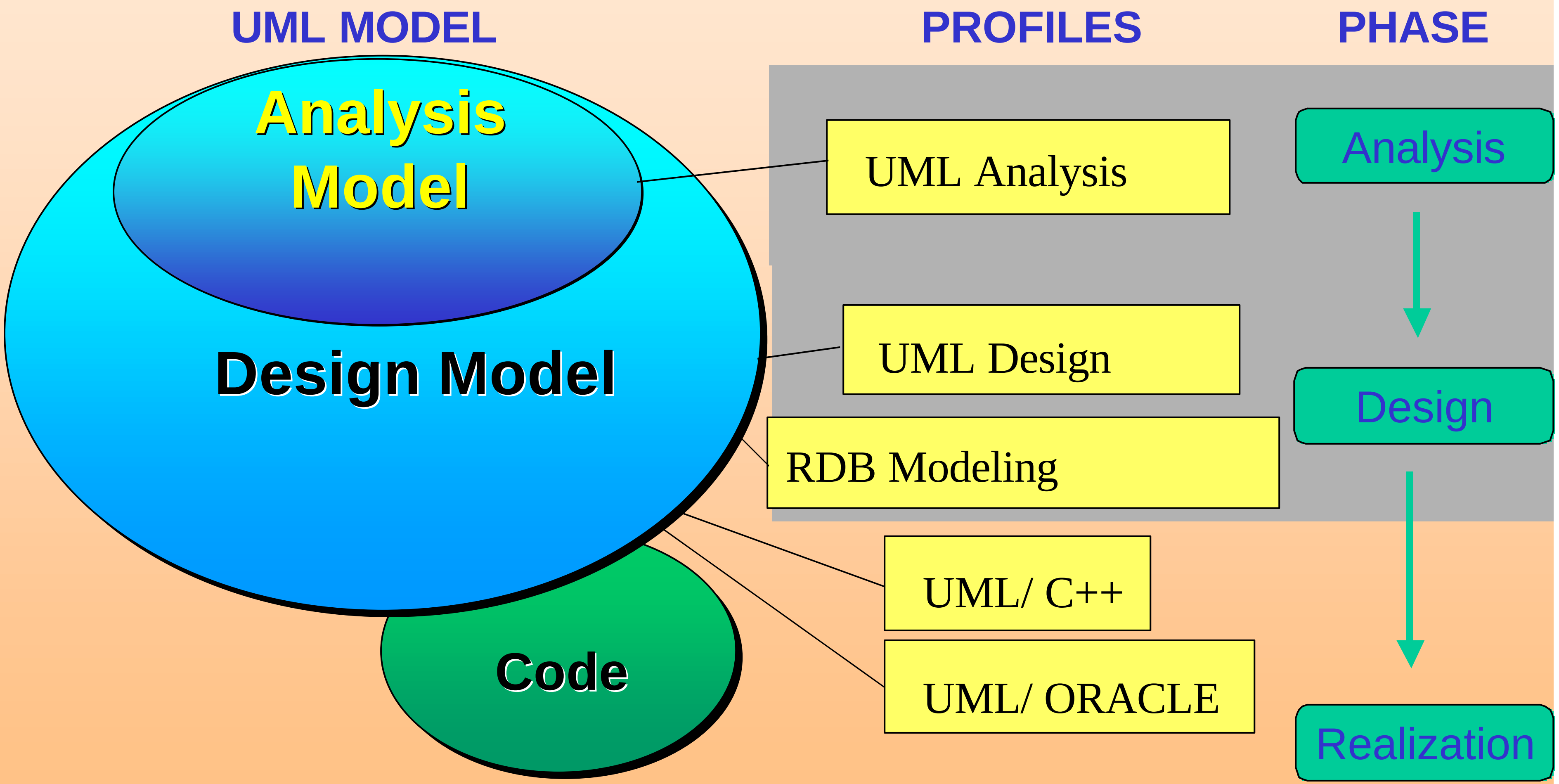
- Your domain is not subject to consensus, many variations and point of view exist
- Many changes and evolutions may occur
- Your domain may be combined with other domains, in an unpredictable way
- Models defined under your domain may be interchanged with other domains

➔ Choose a UML Profile based technique

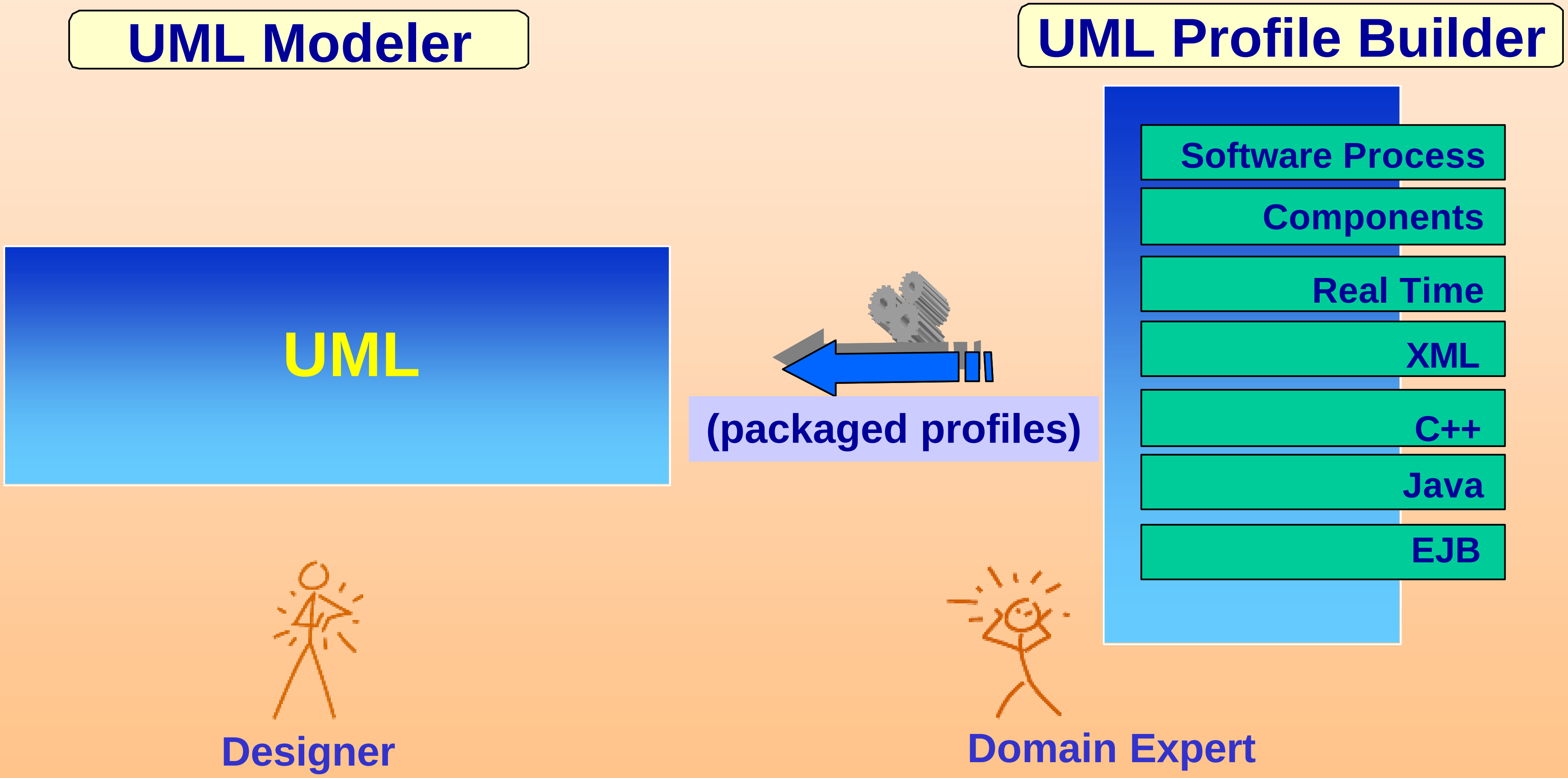
Advanced profile usage

- Structuring case tool customizations using the UML profile mechanism
- Adding procedural features structured by UML Profile, thus providing
  - Inheritance between tool customizations
  - Model transformation rules
  - Model presentation rules
  - Model consistency checks rules

Combining profile for driving software development



Building Profile : a new kind of expertise in software development



UML Modeler

UML Profile Builder

UML

(packaged profiles)

Software Process

Components

Real Time

XML

C++

Java

EJB

Designer

Domain Expert

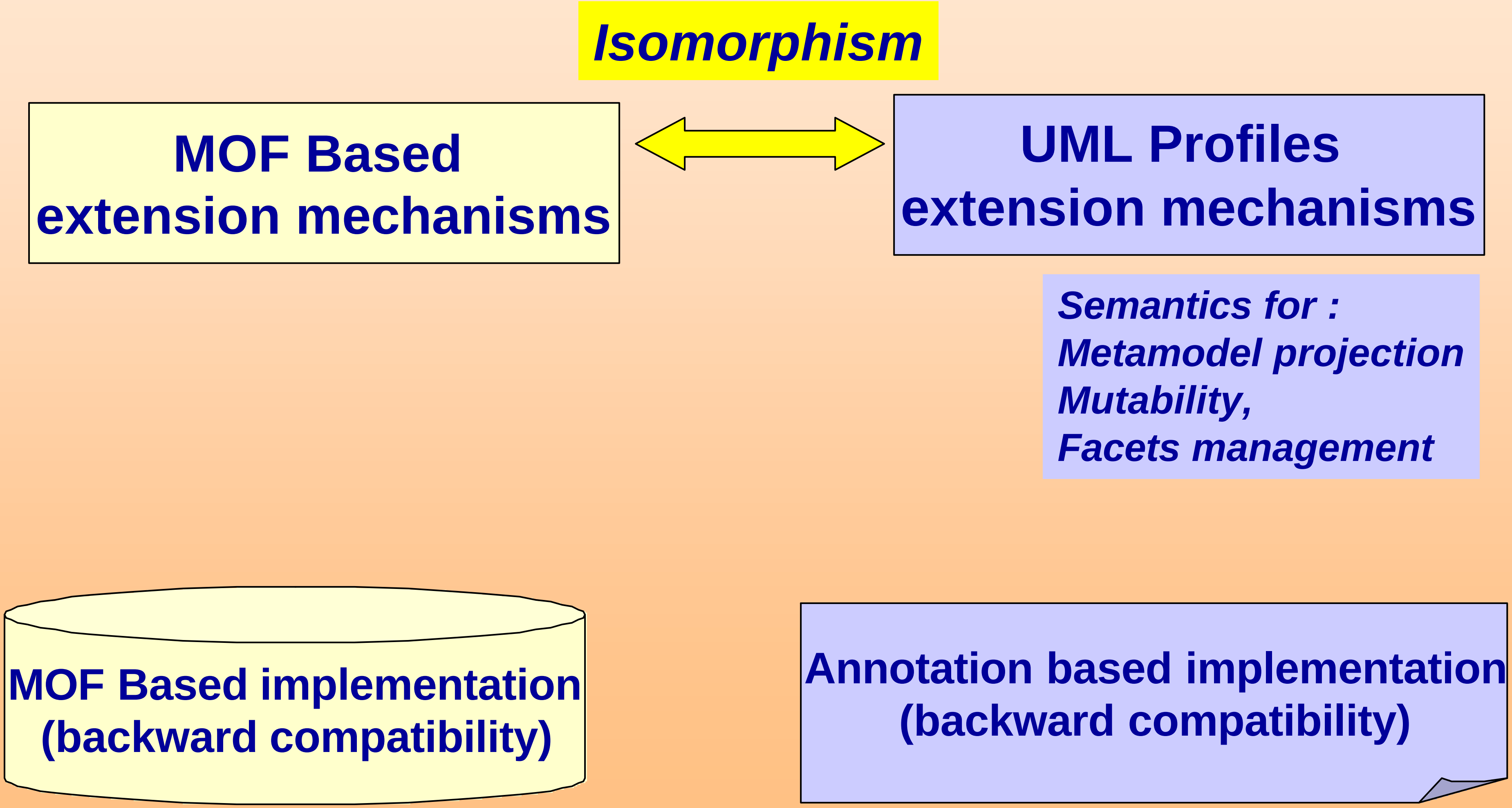
Use a customized Case tool adapted to your domain

Design and implement UML expertise for any kind of domain

Questions to be solved (UML2.0)

- Can the profile mechanism be merged with the MOF mechanism?
- Is it desirable to do so?
- If so there should be specific concepts for
  - specifying the mutability, and view point aspects inherent to the profile technique,
  - providing an absolute guarantee of strong conformance to the reference (MOF based) metamodel.

MOF/Prodiles
A possible Approach for UML 2.0



Isomorphism

MOF Based extension mechanisms

UML Profiles extension mechanisms

Semantics for :
Metamodel projection
Mutability,
Facets management

MOF Based implementation (backward compatibility)

Annotation based implementation (backward compatibility)