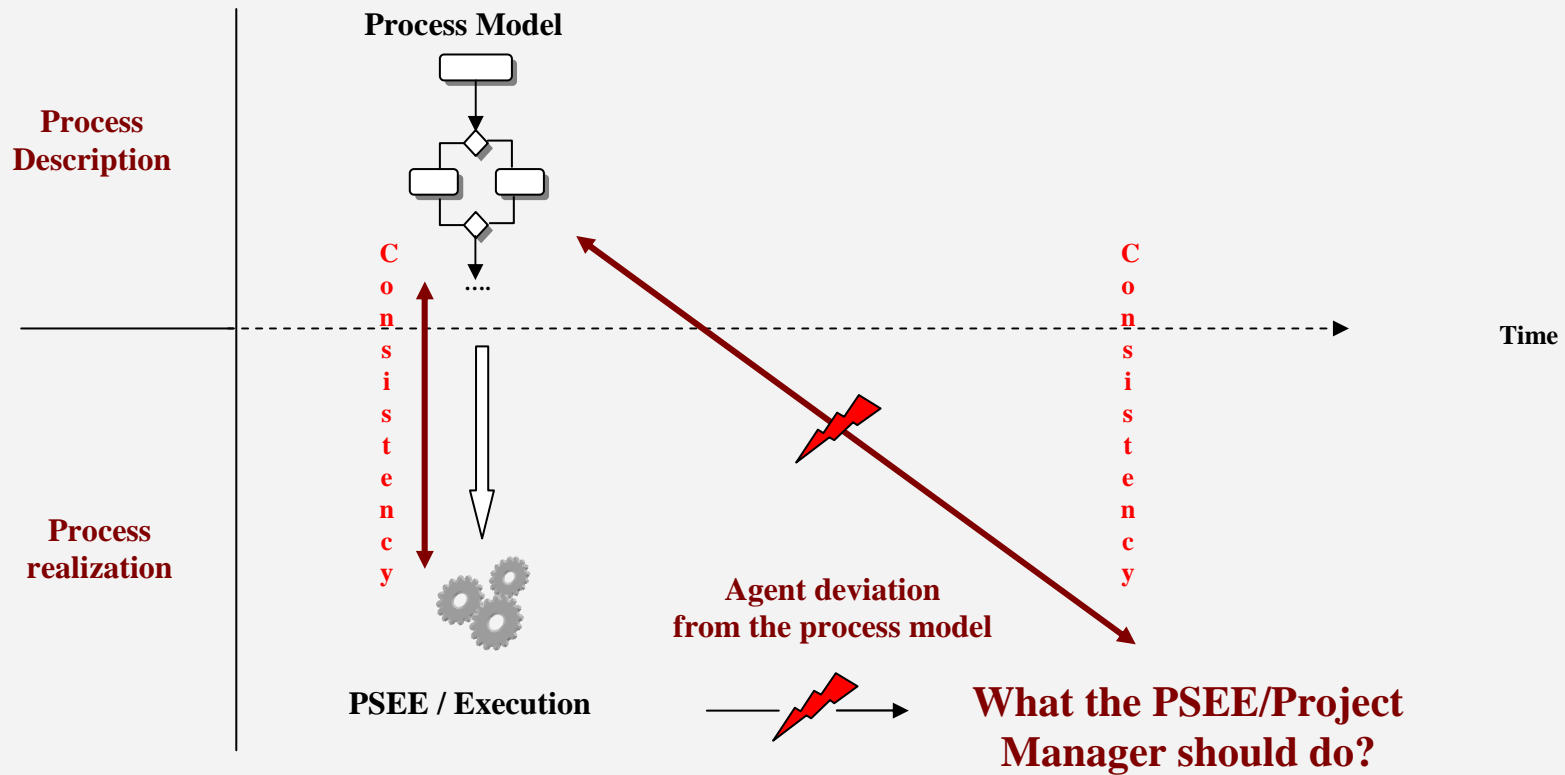


Early Deviation Detections in MDE Processes

(PhD. Marcos Almeida's work – 1st Year)

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Process Deviations



- **Deviation:** any action performed by an agent or a tool during the process execution which is not defined in the process model
- **Deviation Vs Exception** [Lerner et al.]

Agent's deviation effects on the process

- Safety/continuity of the process?
 - No means to prevent the process from a blocking state
 - The deviation level
 - Early Vs Late deviation detections
- Process improvement
 - The process model is not the actual process
 - How can we improve the process model if we have the wrong data (or don't have it at all)?
 - What's the value of the deviating actions?

Dealing with deviations: Current Options

- Stop, modify, restart
 - Not conceivable for long-term processes
- On the fly process model evolution [Bandinelli]
 - Not suitable for minor, temporary deviations
 - Not safe for a certain kind of processes (need for extensive analysis)
- **Common option:** Ignoring the process model and the PSEE
 - Agent's deviations performed outside the control of the PSEE

Intuition

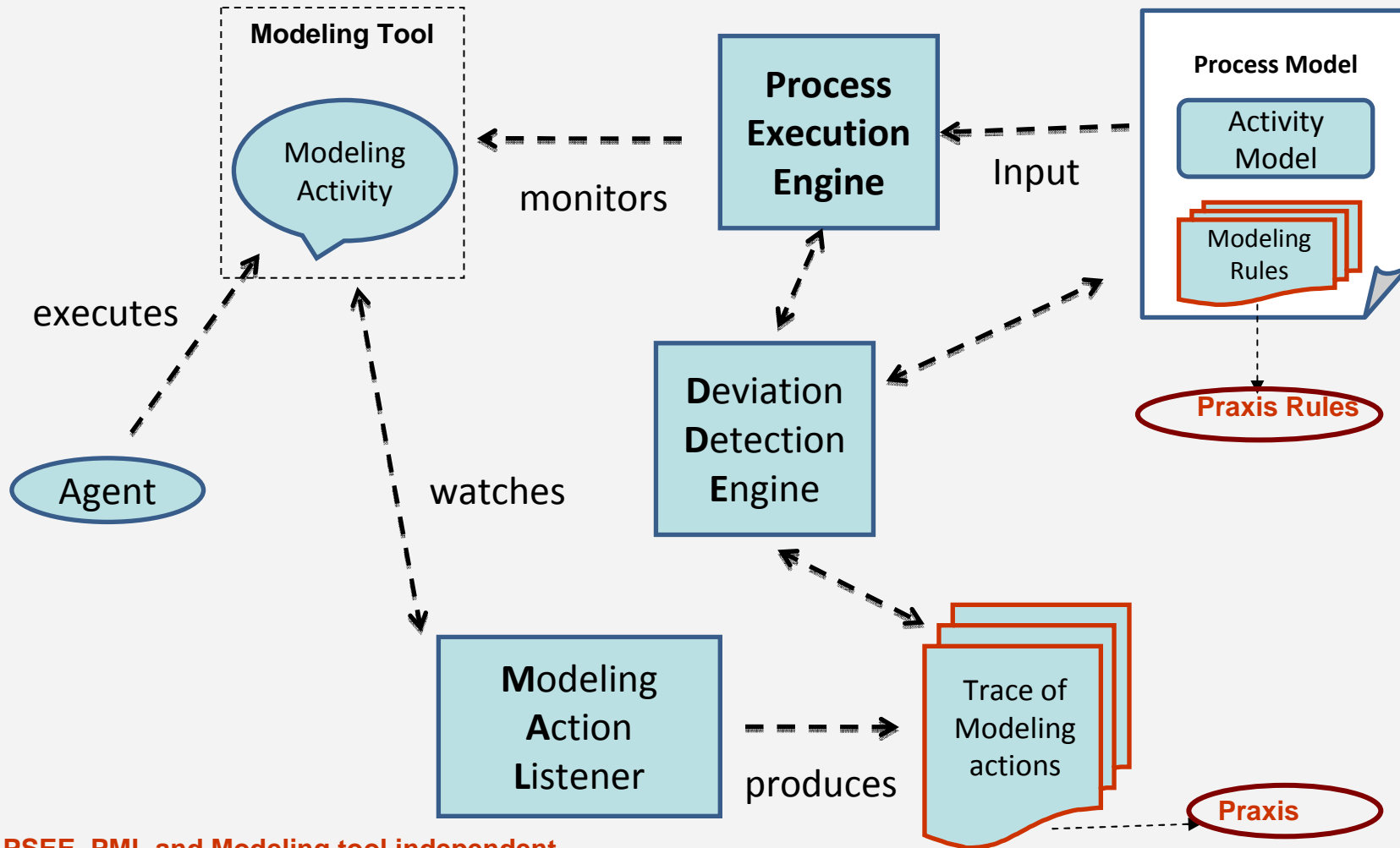
- Assuming that the process model is immutable (100% sound) would be too restrictive
- Proposition: to provide PSEEs and PMLs with an **early detection mechanism** of agent's **deviations** during process's execution
 - Context: MDE Processes
 - Most project deliverables are models
 - Automatically generated/transformed or manually modeled

Architecture for Process Deviation Detection Environments

Requirement

- Usual process execution/monitoring facilities
- Ability to capture agent's deviations
 - Early deviation detections
 - Structural + Behavioral Checks
- Deviation's diagnosis and a proposition of correction plans
- PML, PSEE, and Modeling Tool independent

Architecture

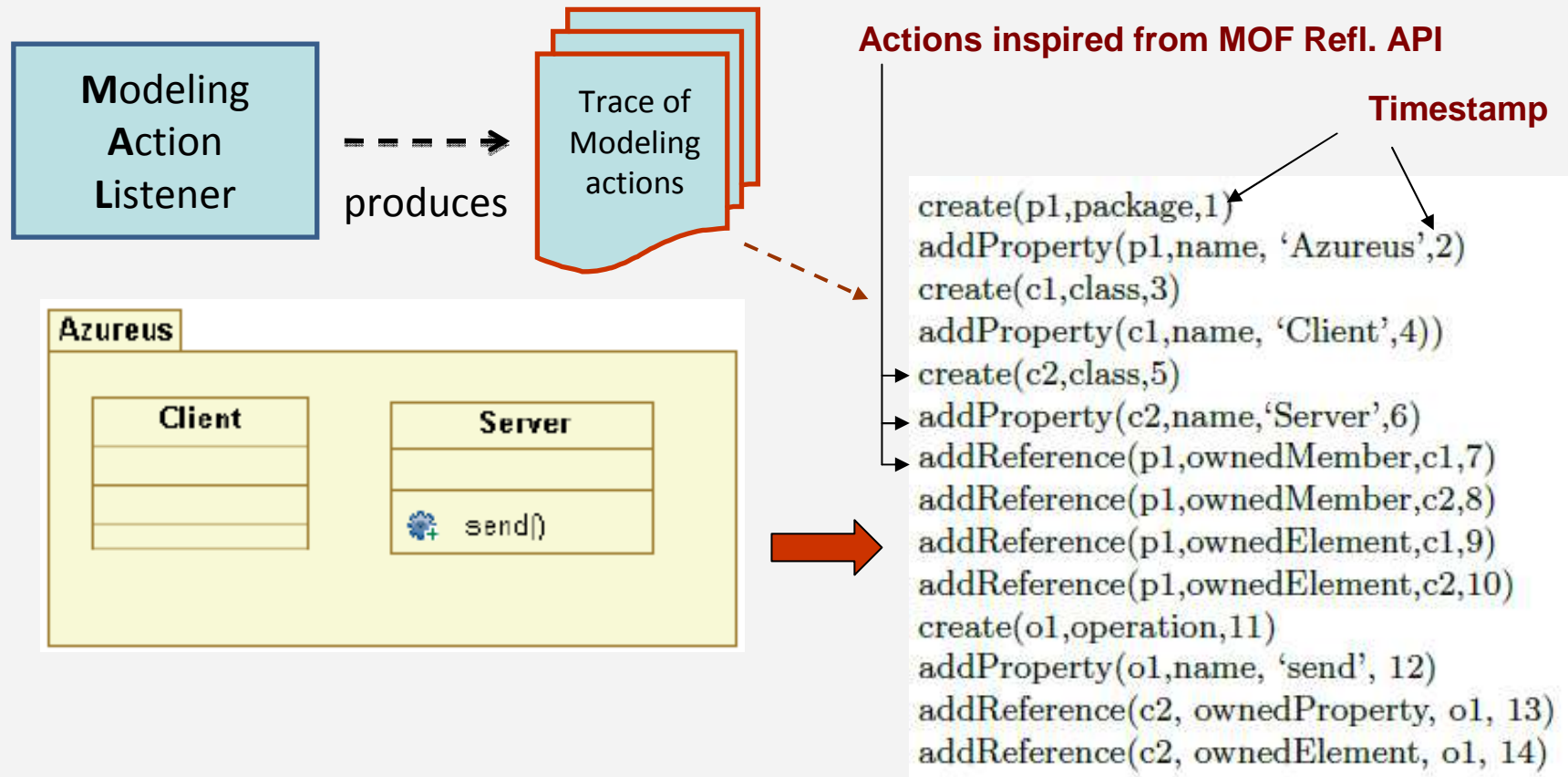


PSEE, PML and Modeling tool independent

Praxis

- Used to represent each of the elementary modeling actions performed by the agent in form of editing actions
- Model construction => a sequence of Praxis editing actions.
- Actions stored in a prolog facts base

Praxis: example

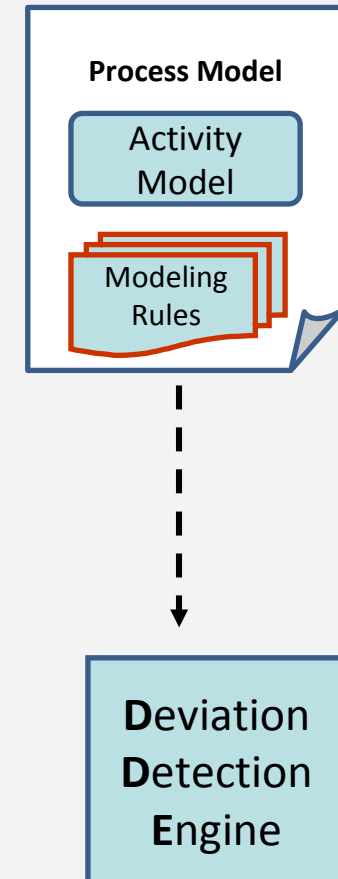


A UML model realized by the agent

Model construction as a sequence of editing actions

Praxis Rules

- A rule-based logical language
- Ensure process's deviations detection
 - Input of the Deviation Detection Engine
- 2 Kinds of rules
 - Activity Post-condition
 - Activity Invariant



Praxis Rules: Activity Post-Condition rules

- Used to specify the structure and constraints of the expected output models of an activity.
=>Structural check

Example

```
createModelPackagePost() <=> and {  
    create(P, #package),  
    addProperty(P, #name, "Model")  
}
```

Praxis Rules : Activity Invariant rules

- Used to define activity's allowed actions and their order in a process model.
⇒ **Behavioral check in form of Invariants**

Example

```
createModelPackageInv() @ operation <=> or {  
operation @ create(P, #package), and {  
create(P, #package), or {  
operation @ addProperty(P, Prop, Val),  
operation @ remProperty(P, Prop, Val),  
operation @ addReference(P, Ref, Elem),  
operation @ remReference(P, Ref, Elem),  
operation @ addReference(Elem, Ref, P),  
operation @ remReference(Elem, Ref, P)  
}}}
```

Praxis Rules : Activity Invariant rules

TemporizedRules

- purely first order logical rules
- describe events in the model construction history
- five different order relations among events
 - Before, After, First, Last and Between**

Example

```
viewPackageCreatedBeforeModelPackage() <=> before {  
    @call createViewPackage(),  
    @call createModelPackage()  
}
```

Validation of the approach

- Prototype implementation
- An empirical study (Briefly presented here)

Prototype implementation

- We used
 - Eclipse Cheatsheets as a PSEE
 - UML2.0 Activity diagram as a PML
 - Papyrus as a modeling tool

Can be any other

 - Praxis tool as MAL
 - A DDE on top of Praxis Rules

PSEE, PML independent
- On-going
 - Integration of the approach to UML4SPM PSEE

Prototype implementation

The screenshot shows the Eclipse IDE interface with a UML diagram in the center. A dialog box titled "Praxis" is overlaid on the diagram, displaying the following text:

Praxis

You are deviating from process specification!

The following action is not allowed according to the current process specification:
create(Maze::Class_0, class)

Refer to the Process Guidance View for details on your current activity.

Do you want to rollback the last actions?

Yes No

The background shows a UML class diagram with several classes and their relationships. On the right side, there is a "Process Guidance" view titled "Refactor MVC" with the following text:

Construire les packages 'Model', 'View' et 'Controller'

Cette étape a pour objectif de construire les packages Model, View et Controller.

Important: Il faut construire les packages Model, View et Controller avant de passer à l'activité suivante.

Click here to finish

Empirical Study

- Objective:
 - Measure the impact of our approach in a refactoring task in terms of time and quality (0-20 grade)

Mistake	Points
Ignored forbidden references	-5
Graphical classes in controller	-6
Model classes in controller	-7
Most controller classes not in controller	-7

- 11 master students from UPMC
 - Process Group: 5 students, with process
 - Control Group: 6 students, without process
- **Hypothesis**
 - Process group would perform its task **faster** and would achieve **better quality models** than the control group.

Results

- Time (average):
 - Process group: 40 min (1 student has not finished)
 - Control group: 55 min (2 students have not finished)
- Quality (average):
 - Process group: 14
 - Control group: 13
- Our results are not statistically representative
 - More experiments are required (F-Test)

Conclusion

- An approach for early deviation detections
- Complementary to current technologies
 - Another means to improve your processes!
- A more important empirical study
 - On-going
- Perspective: Deviation Diagnosis
 - Go further than rollback actions
 - Correction plans in case of late deviation detections