**Accelerating Scientific Workflow Management**

A novel approach to scientific workflows using Aspect-Oriented Thinking (AOT) to support effective capture and reuse of intellectual effort.

**Problem Situation**
Scientific workflows connect together different data sources, components and processes to support research. Existing scientific workflow management methodologies are execution-centric and implementation-focused. This makes it hard and time-consuming to verify the provenance of and reuse existing workflows in a new context.

**Proposed Approach**
An Aspect-Oriented Thinking (AOT) approach to support the capture and reuse of concepts and ideas (intellectual effort) in workflow management. We address workflow context, provenance and agility at the concept- and execution levels, making it easier to rapidly form and evaluate research hypotheses. This will greatly enhance the scientist's ability to understand and intervene in a rapidly changing world.

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**Case-Study: Coupling Ecological Models Across Scale**

**FATE** is a dynamic vegetation model which captures plant community dynamics at the patch level, but it does not model biogeochemical processes. The model code is implemented in the Pascal programming language.

**LPJ** is a dynamic global vegetation model of biochemical processes, coded in the C programming language. Neither FATE nor LPJ can change scale, but need to be coupled together to study plant community dynamics at the global scale.

**Concept-level concerns** in FATE and LPJ are described in terms of patterns representing biogeochemical processes. Programming language concerns will be described independently in patterns for C and Pascal.

**Model-level concerns** (scale, rules for plant-community dynamics) are specified in terms of the concept-level patterns.

**Execution-level concerns** (toolkit, programming language interoperability) are addressed by the automated/manual processing of the model-level workflow specification.

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**Original LPJ**

- A dynamic global vegetation model
- Models biogeochemical processes at many scales
- Models plant community dynamics at global scale
- C code

**C <-> Pascal**

**Coupling Specification Archetype**

- Model-level concerns (scale, rules for plant-community dynamics) are specified in terms of the concept-level patterns.
- Implementation Engine for C Component
- Implementation Engine for Pascal Component

**LPJ <-> FATE**

**Coupling Specification**

- Contextual, explicit constraints:
  - Scale parameter (mortality, initialMortality)
  - Iteration parameter (iterationCount)

**Original FATE**

- A dynamic vegetation patch model
- Does not model biogeochemical processes
- Models plant community dynamics at patch scale
- Pascal code