Unifying Simulation and Visualization environments with Workflow Technology

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Simulation Environment
- Modeling and runtime environment for Simulation Workflows
  - Modeling: creating a workflow
    - BPEL (Business Process Execution Language)
    - BPEL extensions for simulation workflows
  - Runtime: executing an instance of a BPEL based workflow
    - web services support

Phases of a Simulation Workflow
- FEM based Simulation
  - Preprocessing Phase
    - Define Geometry
    - Define Material
    - Create FEM
    - Adjust Boundary Conditions
    - Adjust Initial Conditions
    - Solve Matrix Equation
  - Solving Phase
    - Solve Matrix Equation
    - Postprocessing Phase
      - Intermediate layer with reduced module set for improved usability [4]
      - Export of C++ VTK modules with JNA to a Java based web service
      - the web service provides access to coarse granular VTK functionality
      - Unified simulation and visualization environment
      - all simulation related tasks can be done in a single environment
      - reproducibility of visualization by logging all steps and parameters

Visualization Workflows
- Visualization modules based on the C++ framework VTK [3]
- Intermediate layer with reduced module set for improved usability [4]
- Export of C++ VTK modules with JNA to a Java based web service
- the web service provides access to coarse granular VTK functionality
- Unified simulation and visualization environment
- all simulation related tasks can be done in a single environment
- reproducibility of visualization by logging all steps and parameters

Figure 1: The Modeling environment for Simulation Workflows based on the Eclipse BPEL Designer and includes extensions, e.g. for data management activities [1].

Figure 2: Typical activities of a finite element method (FEM) based simulation. The simulation can be divided into a preprocessing, solving, and postprocessing phase [2].

Figure 4: BPEL workflow for simulation (left) and visualization (right). The visualization workflow visualizes 3D result data on two different views (bottom).

Literature