iVEL – A grid-based Virtual Engineering Laboratory

Michael Polter
Institute of Construction Informatics, TU Dresden

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Platform Motivation

- Huge amount of simulations / parametric studies during building design process
- SMEs lack of ability to bundle their available computing resources for complex simulations
- Requirements for software systems:
  - Automation of simulations
  - (semi-) automatic generation of model instances
  - Storage / filtering /evaluation of results
  - Advanced information management
  - Collaboration possibilities
  - location independent

→ provide distributed users a shared platform with computational power, accessible from arbitrary devices
The Project SE-Lab

- Virtual Structural Engineering Laboratory
  - „A Cloud-/Grid-based Virtual Laboratory for Non-Linear Probabilistic Structural Analysis“
  - Funded by German Federal Ministry of Education & Research and EUROSTARS
  - Duration: 36 months (12/2012 – 11/2015)
  - Partners:

Cervenka Consulting, s.r.o.
Praha, Czech Republic
Technische Universität Dresden
Institut für Bauinformatik
Germany
Leonhardt, Andrä und Partner
Beratende Ingenieure, VBI, GmbH
Dresden
• **Service-oriented architecture** (modular extension possible)
• **Layered, component based** structure, well-defined interfaces
• Integration of **computational kernels as web services**
  ▪ Enables porting of computations to **grid-/cloud environment**
• **Web browser based** user interaction
• **Collaboration** support
Figure x: iVEL top-level architecture
• Centralized data management
• Decentralized computation of simulations
• Flexible selection of computation infrastructure by user:
  ▪ **HPC server** owned by company for sequential computation of huge models
  ▪ **UNICORE** based **private grid** consisting of employee's machines for parallel computation
  ▪ **Public HPC cloud** (if local resources are not sufficient)
Why UNICORE?

- MS Windows compatible
- Java API
- Huge functional range
- Under active development
- active community
Computational Service - Workflow

Process Layer

Algorithm Layer

Hardware Layer

Grid Nodes

Process P1

Job J1

Job J2

Job J3

Job AJ1

Job AJ2

Job AJ3

Simulation Request

model file

batch file

Sofistik

Atena

...

Server

UNICORE Grid

Cloud

UNICORE HiLA

Grid Nodes
iVEL - Summary

Company A Grid

Company B Grid

UNICORE

iVEL Platform

Karlsruhe, 07.09.15

IVESL – a grid-based Virtual Engineering Laboratory

Slide 9 of XYZ
Planned Improvements

- **Utilization of workflow system** for effective schedule of pre-, main- and postprocessing tasks
- **Utilization of resource descriptions** ~
  - Definition, exploitation
- **Integration of FILESPACE** of nodes as active storage element
Thank you for listening!

Michael Polter
email: Michael.Polter@tu-dresden.de
Figure x: Distributed execution of simulation tasks
iVEL Platform – layers

- Web Browser
- sequential
- parallel
- ATENA
- single server
- UNICORE Grid