Flood application on gLite

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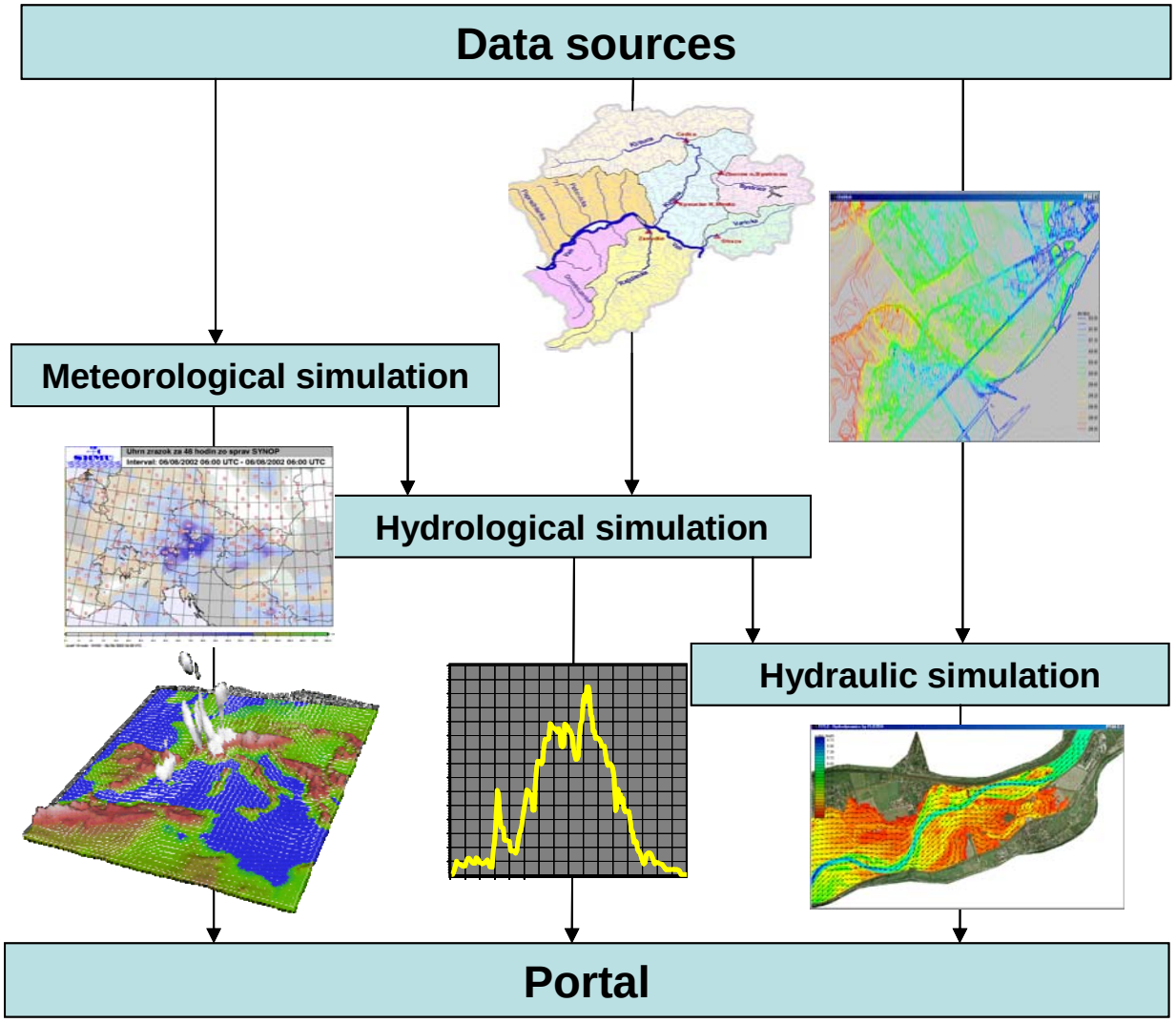
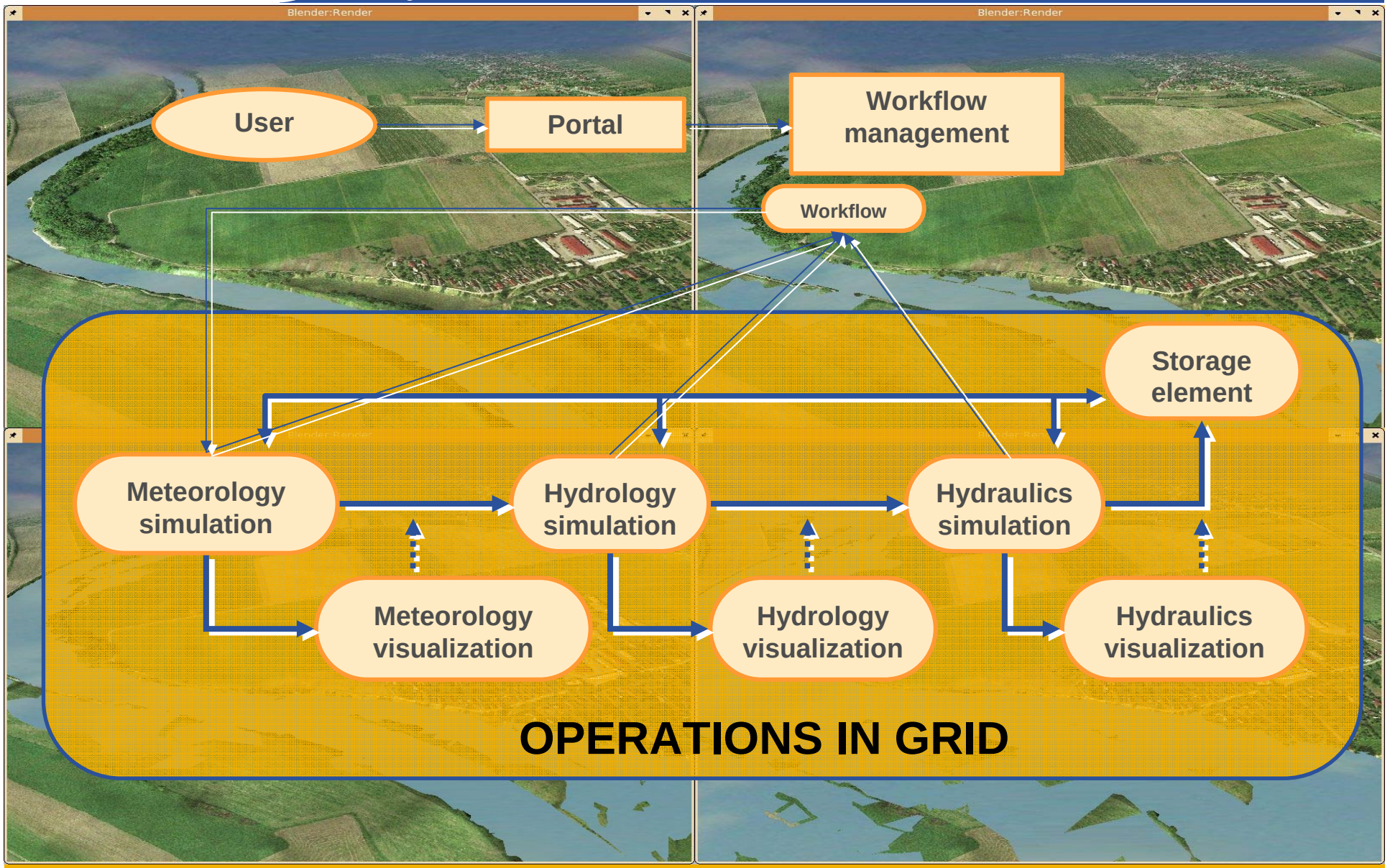
History of Flood application

- **Flood application is continually developed in**
  - ANFAS: datA fusioN for Flood Analysis and decision Support,(2000-03) IST-1999-11676
    - Data fusion, hydraulic modeling
    - Cluster computing
    - Remote processing
  - CrossGrid: Development of Grid Environment for Interactive Applications (2002-05) IST-2001-32243
    - More models (meteorology, hydrology)
    - Grid computing
    - Metadata catalog
    - Portal
  - **EGEE: Enabling Grids for E-sciencE (2004-2006) INFSO-RI-508833**
    - **Porting to gLite**
    - **Working in Earth Science Research Virtual Organization (ESR VO)**
  - Kwf-Grid (Knowledge Workflow Grid)
    - Porting to web services
    - Building knowledge system for flood application
- **Collaboration with Slovak Hydro-meteorological Institute (SHMI) and Slovak Water Research Institute (WRI)**

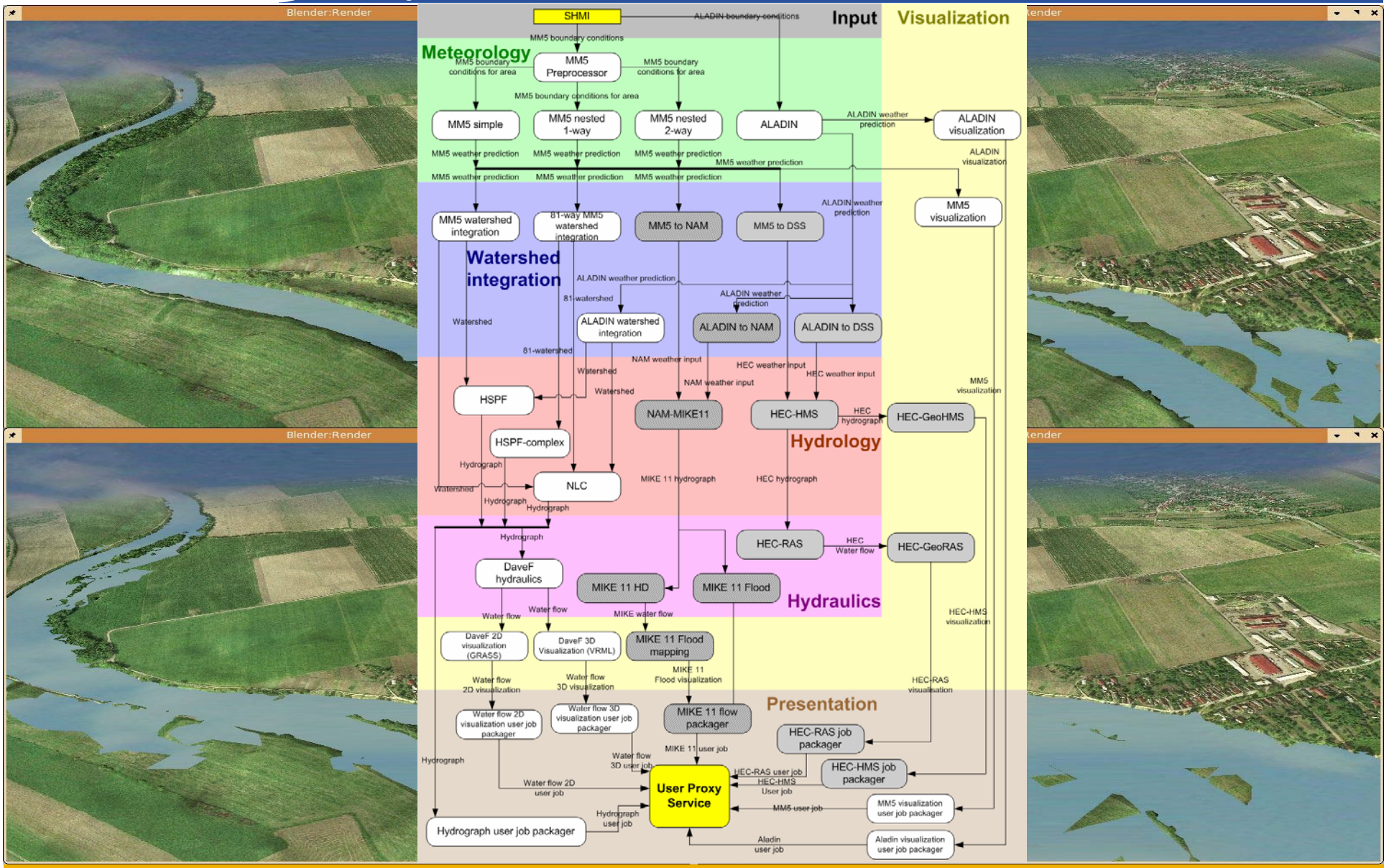
Flood forecasting problem



Simplified scenario



Full scenario



Flood forecasting and Grid

- **For critical situations**
  - Needs to run many scenarios at the same time (worst-case scenarios for risk analysis)
  - Needs to have results as accurate as possible (higher resolutions for simulations -> higher computational power)
  - Needs to have results as soon as possible (every minute is important)

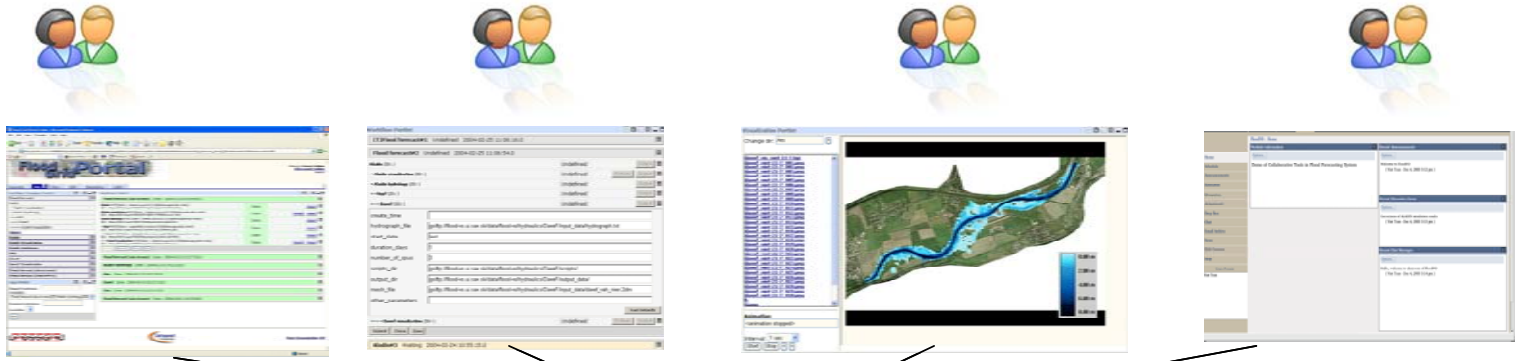
  ⇒Needs grid computational power
- **For collaborations:**
  - Different user groups: meteorology, hydrology, hydraulics, river authorities, crisis team, …
  - Different countries: for international rivers like Danube
  - Sharing resources: data, computational powers, expertise, …

  ⇒ Grid is the technology for collaborations

FloodGrid portal

- **Portal is accessible from anywhere:**
  - Needs only network connection and web browsers
  - Users can use portal also from mobile devices (very important for field work)
- **Portal is the “meeting point” for users:**
  - Users need to collaborate on flood forecasting
- **Portal hides complexity of Grid computing:**
  - The main users of the portal may be experts in meteorology, hydrology, … but not in Grid computing
- **Portal increases the security**
  - Some data and information from flood forecasting are sensitive
  - Portal has additional security level
  - Users cannot run other code than the portal allows

FloodGrid Portal



Portal

Workflow management | Data management | Visualization | Collaboration

Models

ALADIN | HSPF | DaveF

Data

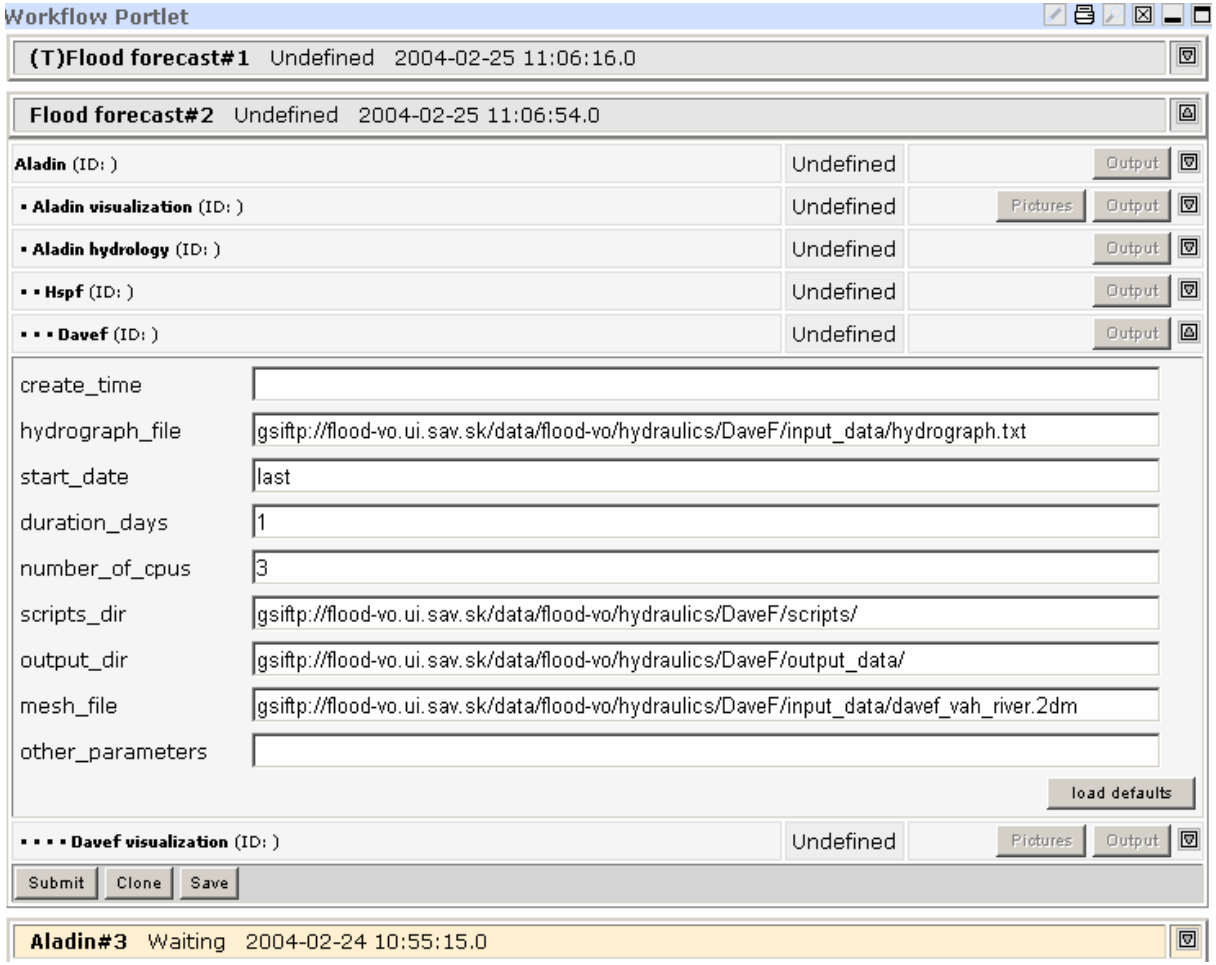
GRID

Computational resources

Workflow management

- Manages and executes jobs with data dependences
- Cooperates with gLite resource broker to find suitable computing element for running simulation
- Monitors status of jobs
- Abilities to use predefined workflow templates, spawning running workflow, modifying parameters of jobs

Workflow management



Data management

- **Many kinds of data in FloodGrid**
  - Meteorological, hydrological, hydraulic
  - Generated by simulations or obtained from sensors
  - Permanent or periodically updated
  - Publicly available or with restricted access
- **Using metadata catalog for describing data**
- **Data are stored in storage elements and are accessed via Grid protocols**
- **Operation: query, adding, modification, deleting**

Visualization

- **Multiple visualization modes according to models and visualization tools**
  - Texts
  - Pictures
  - Animations
  - Virtual reality

Visualization

Visualization in Virtual Reality

- In cooperation with GUP, Joh. Kepler University, Linz

Collaboration

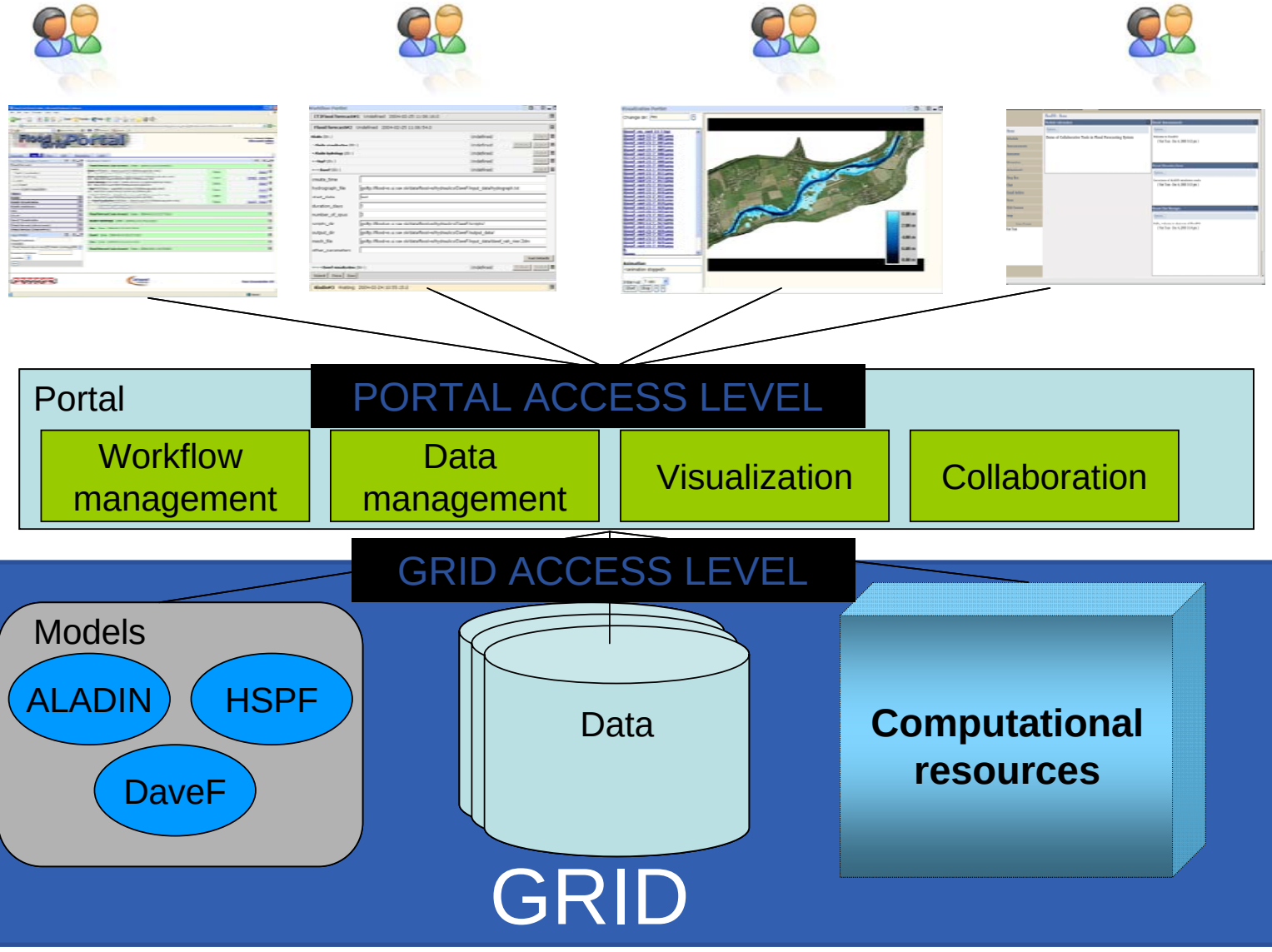
- Different users groups (experts in meteorology, hydrology, hydraulics, crisis team, river authorities) need to collaborate on flood application
- Portal provides different means of communication among users: chats, mailing lists, discussion groups, file sharing
- Collaboration via other shared tools of portal

Collaboration

Security

- **Two level of securities: Portal level and Grid level**
- **Portal level:**
  - Secure HTTP access
  - Authentication by user names/passwords
  - Access controls for every tools/resources at portal (individually or by groups)
  - Only for accessing tools/resources located on portal. For accessing physical data, models or computing resource, Grid certificates are needed
- **Grid level:**
  - Authentication by Grid certificates
  - Using Grid communication protocols

Security


Portal
PORTAL ACCESS LEVEL
Workflow management
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Models
ALADIN
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Computational resources
GRID

Live demonstration on GILDA

Flood application and gLite

- **Requirement: Different user groups (experts, river authorities, crisis team, public) have different access rights to resources**
  - In LCG, all users in a virtual organization have the same right, they need to trust each other
  - That can be considered as security hole: any person in VO can read/modify/delete shared data of whole VO
  - This problem was partially solved using access control in portal
- **gLite provides solutions for this problem**
  - VOMS with different access rights for different user groups
  - ACL (Access Control List) support for data management
- **Job submission has been ported to gLite**
- **Data management will be next**

Conclusion

- **Flood forecasting can save many lives and money**
- **Grid computing is needed:**
  - For faster simulations
  - For more accurate results
  - For connecting people and resources together
- **gLite provides new features for improving security of flood applications**

Future work: Flood application for international river