The Thirteenth International Conference on Advanced Geographic Information Systems, Applications, and Services
GEOProcessing 2021
July 18, 2021 to July 22, 2021 - Nice, France

Perspectives and Challenges of Quantum Computing in Geo-Engineering Domain

A Short Technology Survey

Presented by: **Alexey Cheptsov (cheptsov@hlrs.de)**

CONTENT

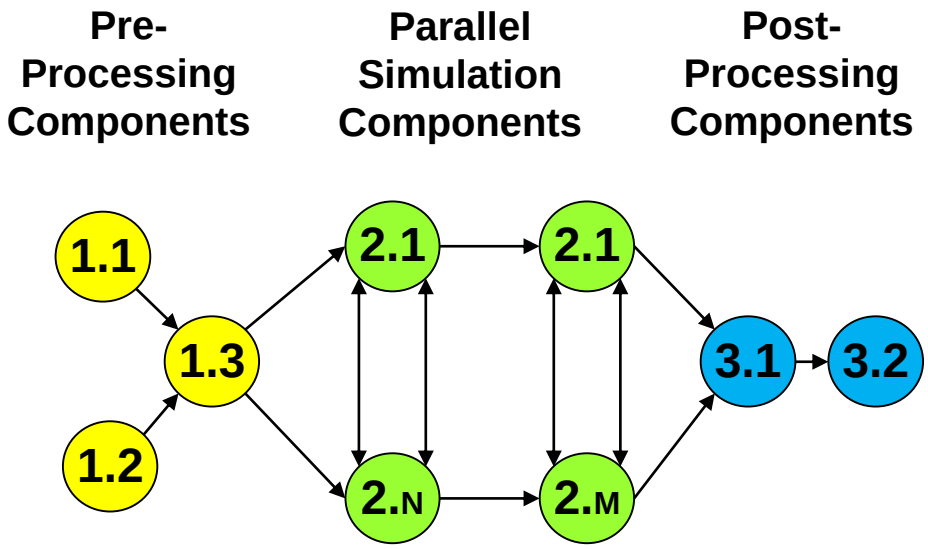
CONTENT

ChEESE: Center of Excellence in Solid Earth

- A EU-funded preparatory action for the upcoming Exascale supercomputers
  - Establishes a new Center of Excellence (CoE) in the domain of Solid Earth (SE)
  - Addresses 15 scientific, technical, and socio-economic Exascale Computational Challenges (ECC) in the domain of SE.
  - Develops 12 Pilot Demonstrators (PD) and enable services oriented to society on critical aspects of geohazards like hazard assessment, urgent computing, and early warning forecast.
  - Integrate around HPC and HDA transversal European institutions in charge of operational geophysical monitoring networks, Tier-0 supercomputing centers, academia, hardware developers, and third-parties from SMEs, Industry and public governance bodies (civil protection).
- www.cheese-coe.eu

ChEESE: Need of Workflows

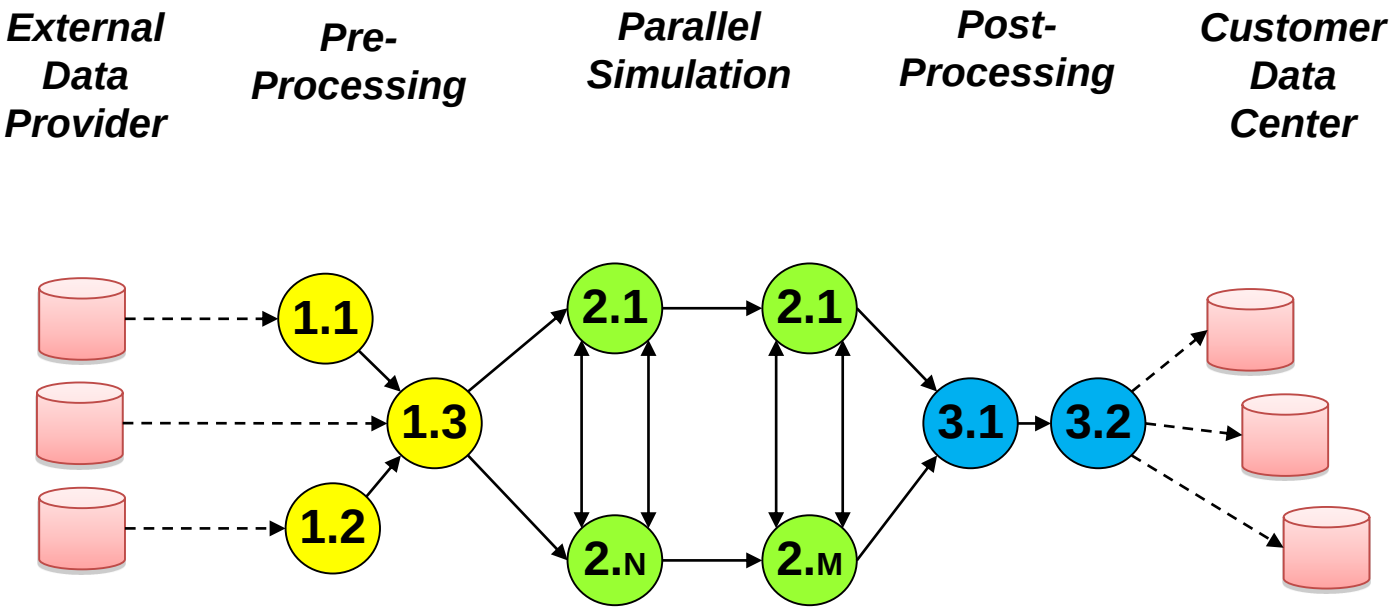
- Many geoscience applications are built of coupled codes, running on distributed HPC and Cloud resources
  - Pre- and post-processing
  - Simulation
  - Visualization



CONTENT

Deployment and Execution Challenge

(1) Use of external databases / storage locations

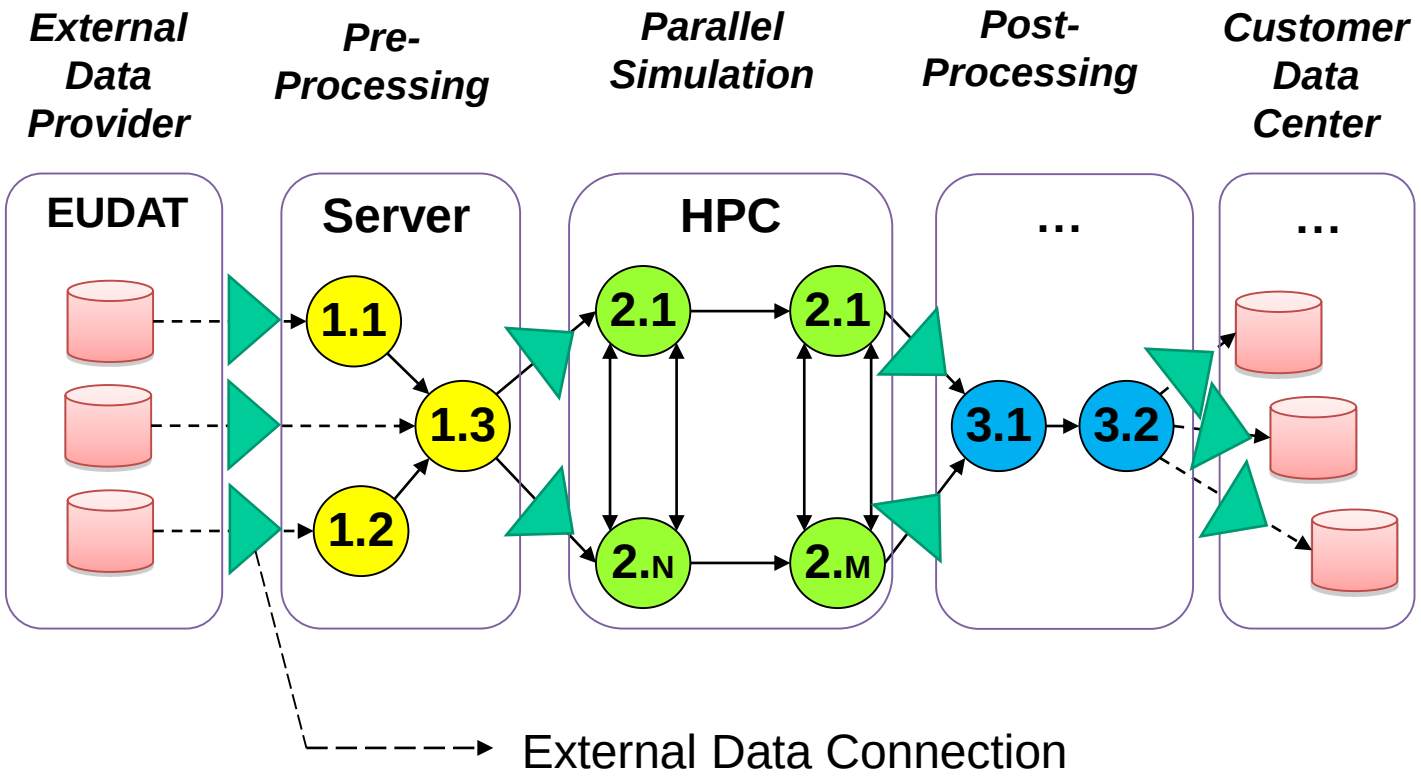


Deployment and Execution Challenge

(1) Use of external databases / storage locations

(2) Distributed Computing- and Data-Infrastructure

ChEESE



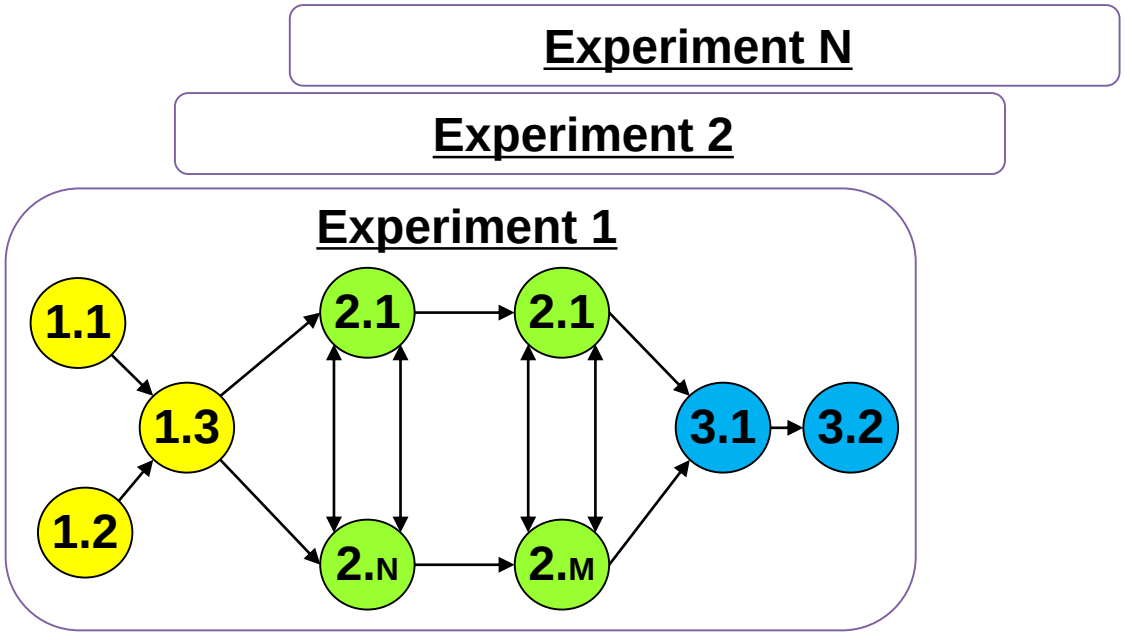
Deployment and Execution Challenge

ChEESE

(1) Use of external databases / storage locations

(2) Distributed Computing- and Data-Infrastructure

(3) Need to perform/track multiple experiments (e.g., parametric studies)



CONTENT

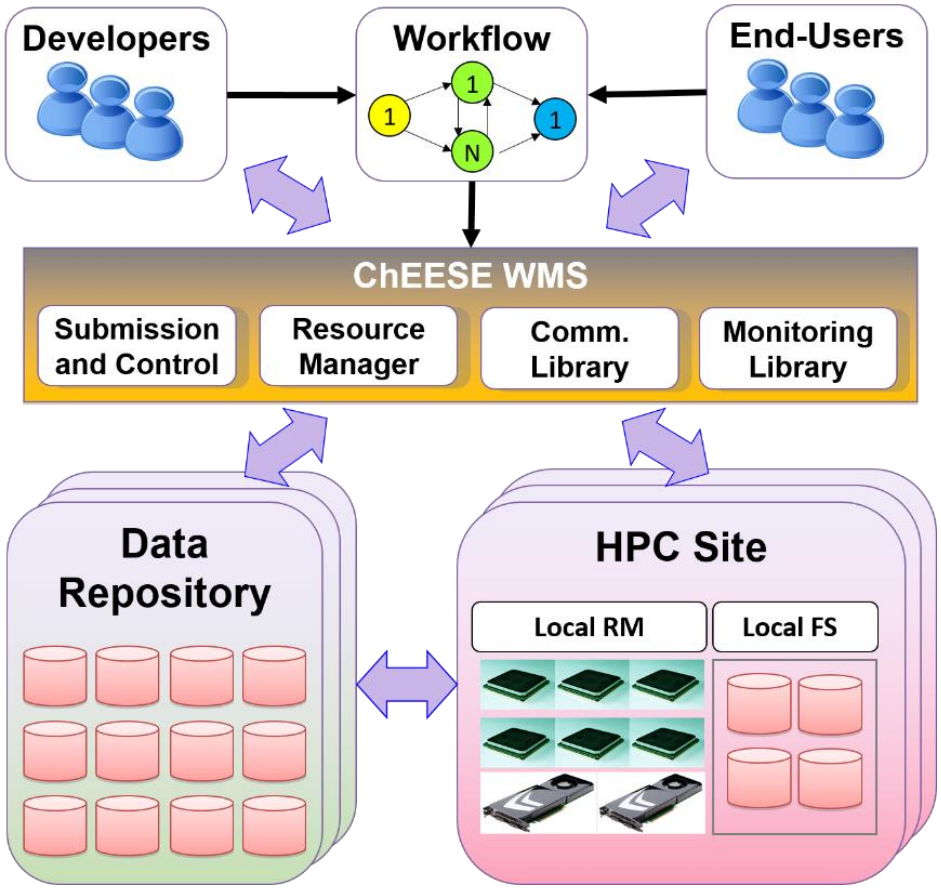
Workflow Management Solution of ChEESE

ChEESE

- **WMS-light**
  - **Set of light-weight Java components and shell scripts for launching/management/tracking of the execution of component-based, data- and control-flow interconnected distributed applications (workflows)**
  - **Allows automation of the everyday's routine operations (submission of applications to HPC schedulers, execution, copying data, etc.), which are frequently performed manually and are thus very time-consuming.**
  - **On-the-fly deployment on any supported infrastructure (incl. HPC) due to 0-inference into the system software layer of the targeted infrastructure.**
  - **All middleware runs on the client side → allows integration with almost any compute infrastructure with a minimum of performance overhead**

Workflow Management Solution of ChEESE

- **WMS-light Architecture**



User-Defined Workflows

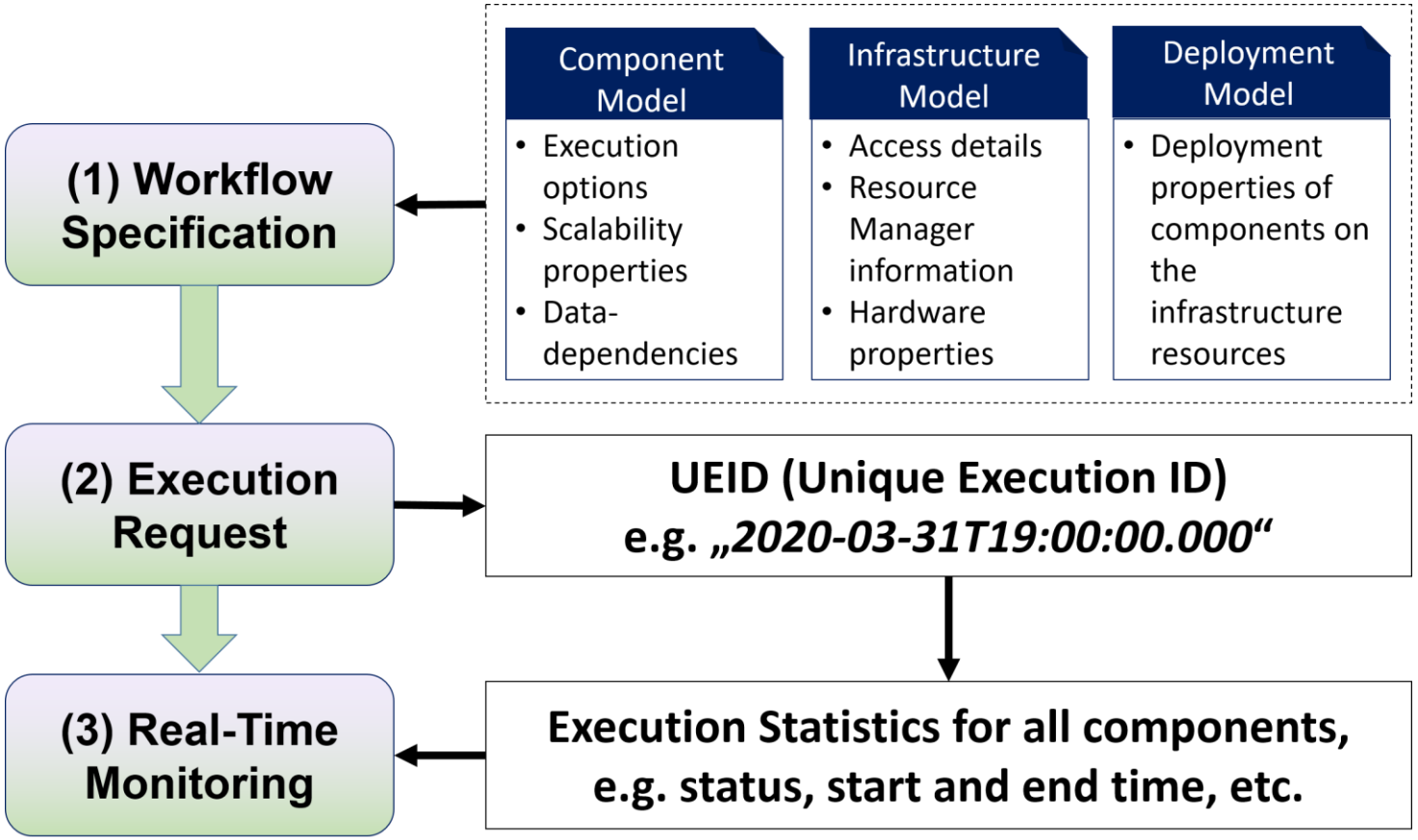
Workflow Management System

Federated Infrastructure

Workflow Management Solution of ChEESE

ChEESE

- **Major Specifications**
  - **To be provided in flexible JSON-format**



CONTENT

Discussion Round

- **Infrastructure**
  - Germany – 1st commercial QC (Fraunhofer)
- **Applications**
  - Geo-science workflows
- **Programming Models and Tools**
  - Standard HPC libraries?