International PostExascale

Workshop Series

InPEx 2025 workshop – April 14-17, Japan

InPEx working groups results

Digital continuum and data management – Session 1

Session Co-leads: Gabriel Antoniu (Inria), Manish Parashar (U Utah), Kentaro Sano (RIKEN)

Digital Continuum and Data Management Session1: Use case presentation

International Post-Exascale Initiative

For Use case characterization, identification of shared challenges and potential solutions:

1 **[SKA] Direction-Dependent Facet (DDF) calibration Use-Case and the ODISSEE project**
- Mathis Certenais (U Rennes)/Damien Gratadour (CNRS/Observatoire de Paris) et al.

2 **[HEP] HEP use cases for HPC** - Maria Girone et al. (CERN)

3 **[ESiWACE] A Workflow for HPCW**
- The High-Performance Climate & Weather Benchmark - Mario Acosta, Miguel Castrillo et al. (BSC)

4 **[Urgent computing] Facilitating trade-off management on the Edge - Cloud Computing Continuum for Urgent Science** - Manish Parashar (U Utah), Daniel Balouek (Inria).

Each use case presents the corresponding challenges/roadblockers and initial approaches to tackle them. To help identifying commonalities, all use-case representatives are requested to comment on the criteria identified.

Initial Challenges

1. Access to HPC resources (as a community)
2. Interface to federation of resources (e.g. EuroHPC)
3. Co-design for the post-exascale systems
4. Portability of the benchmarks and codes
5. Deployment issues of the workflows and applications
6. Metrics for different deployment scenarios
7. Semantics and quality of data
8. Resources provisioning
9. End-to-end workflow control
10. Multi-tenancies
11. Data logistics

1 [SKA] Direction-Dependent Facet (DDF) calibration Use-Case and the ODISSEE project

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Some challenges:

- Portability, scale, data logistics, deployment on the continuum

Specific challenge: real time stream processing at high rates (Tb/s)

- Interoperability (and Reliability, Availability, Serviceability) between sub-systems across the continuum from real-time data streaming and high throughput data reduction, to science production leveraging federated HPC centers.

2 [HEP] HEP use cases for HPC - Maria Girone et al. (CERN)

- In addition to traditional HPC use cases, AI/ML use cases illustrate :
  - Next generation triggers: GPU-powered training
  - Distributed AI model training
  - Digital twins
  - LLMs: retrieval
  - Predictive maintenance

- Technical challenges
  - Integration and interfaces - lack of standard interfaces HPC-WLCG interface protocols, collaboration on HPC federation
  - Federated authentication
    - At NSF there is single sign-on
  - Portability to GPUs (traditional codes are not optimize for GPUs)
  - Studies in progress for energy efficiency and long-term sustainability

3 [ESiWACE] A Workflow for HPCW

- The High-Performance Climate & Weather Benchmark - Mario Acosta, Miguel Castrillo et al. (BSC)

HPCW: The High-performance climate & weather benchmark

- Reproducibility: CMake, SPACK, CTest

- Roadblockers
  - Portability and interoperability
  - Validation: end-to-end metrics
  - Representativeness of the benchmark
  - Communication with vendors
  - Integration with CI/CD frameworks
  - Opportunity to apply benchmarks for testing new HW for post-exascale supercomputing

4 [Urgent computing] Facilitating trade-off management on the Edge - Cloud Computing Continuum for Urgent Science - Manish Parashar (U Utah), Daniel Balouek (Inria).

Technical challenges

- Managing QoS under constraints and uncertainty
- Dynamic discovery and allocation based on current needs
- NSCR: National Strategic Computing Reserve
  - A blueprint now

Next session at 16:30

Additional use cases

Using High-performance Imaging and Advanced AI Analytics to Inspect Road Infrastructure,

- Peng Chen, RIKEN R-CCS, and Mahamed Wahib (RIKEN R-CCS)

Micro-meteorology control project

- Prof. Ryo Onishi, Science Tokyo
    - https://www.turb.gsic.titech.ac.jp/en/project/project.html

Disaster Digital Twin Project

- Prof. Shunichi Koshimura, Tohoku University

Challenge-based discussion

- What common challenge seems the most important to you?
- What are the concrete technical gaps? How would you address them?