



PRACE Operational Services for the HPC Eco-system

**EUDAT – PRACE Summer School on managing scientific data from analysis to
long term archiving, 23-27 September 2019, Trieste, Italy**

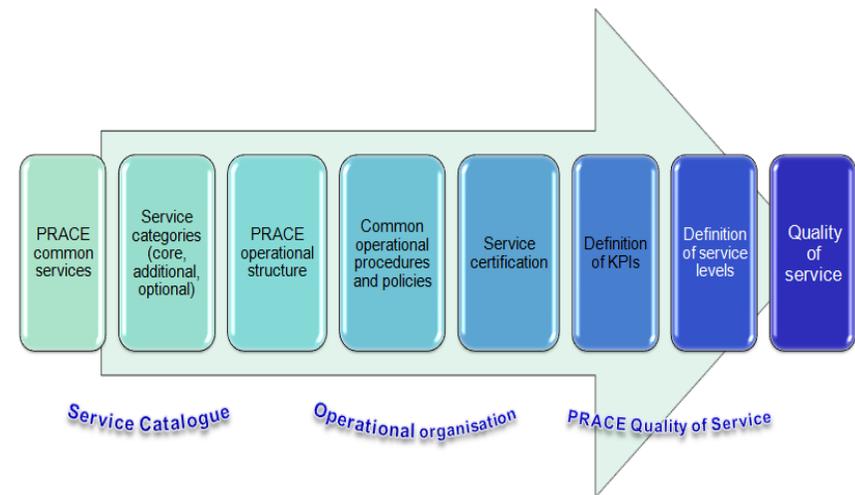
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Operation and Coordination of the Comprehensive common PRACE Operational Services

- ▶ Operation of the PRACE infrastructure monitored and coordinated
- ▶ Working on the PRACE infrastructure as a whole ecosystem rather than a collection of different systems
- ▶ Responsible for both Tier-0 and Tier-1 systems providing Tier-1 for Tier-0 services

Infrastructure and common services:

- Consolidated Operational Structure and Procedures
- PRACE Service Catalogue
- Implement operational Key Performance Indicators
- Security Forum to address security issues



PRACE Operational Coordination

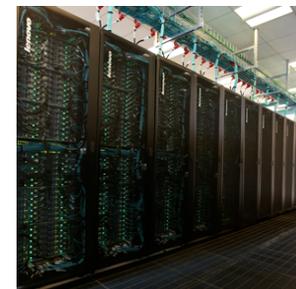
Matrix-structured organisation for Operations

- Networking,
- Data,
- Compute,
- AAA,
- User,
- Monitoring,
- Generic,
- Operational security

Site representatives are responsible for services at their site

PRACE Tier-0 Systems

- Seven Tier-0 systems now in production
 - JUWELS @GCS/FZJ **9.9 PFlop/s**
 - HazelHen @GCS/HLRS **7.4 PFlop/s**
 - SuperMUC-NG @GCS/LRZ **26.9 PFlop/s**
 - IRENE @GENCI/CEA **8.9 PFlop/s**
 - MareNostrum4@BSC **10.2 PFlop/s**
 - PizDaint @ETH-CSCS **27.1 PFlop/s**
 - Marconi @CINECA **20.0 PFlop/s**
- **110 PFlop/s** in total at present
- **It was 71 PFlop/s** in April 2018



Deployment of Tier-1 Systems

- 23 Tier-1 for Tier-0 systems are operated in 19 PRACE sites distributed in 16 different European countries
- Tier-1 systems provide a total of peak performance of **29 PFlop/s**
- Most of the Tier-1 systems are accelerated with GPU cards or Intel co-processors (Xeon Phi)

Network Services

- ▶ The main task is the general operation of the Multi Domain Virtual Private Network (MD-VPN) including the optimisation of the network parameters
- ▶ A monitoring solution based on perfSONAR and in collaboration with GÉANT is implemented experimentally by BSC, CINECA, CSCS, IT4I, KIFU and JUELICH.

Data Services

- ▶ The replacement of Globus Toolkit (no more officially supported) by Grid Community Toolkit (GCT), its Open Source counterpart, is at present under way

Compute Services

- ▶ An increase in the adoption of SLURM has been recorded (mainly due to the open source and customisability features)

AAA Services

- ▶ Tight collaboration with GÉANT to establish a general federated authentication and authorization infrastructure (post AARC)

Operational Security and Security Forum

- ▶ No major intrusions have been monitored and no services have been at risk
- ▶ PRACE CSIRT listed in the GÉANT Trusted Introducer program

User Services

- ▶ PRACE User Documentation: continuously updated and stored in the PRACE SVN repository
- ▶ Improvement and harmonisation of the «modules» environment

Monitoring Services

- ▶ All the data are available to the PRACE staff in a website powered by Icinga2 aggregating all the sites/services status
- ▶ Under monitoring: 23 sites, 10 generic services, 85 host objects

Generic Services

- ▶ In collaboration with PRACE MB, BoD and PRACE aisbl, a plan to implement the GDPR measures was successfully achieved
- ▶ Migration from the PRACE SVN to a GIT-based repository

Analysis and Development of Prototypal New Services

- Objective: Analyse new innovative services and investigate their prototypal implementations. **Service 4** was promoted to regular service during last year.
- Prototypal services:
 - **Service 1**: Urgent Computing
 - **Service 2**: Links to large scale scientific instruments
 - **Service 3**: Smart post-processing tools including in-site visualisation
 - **Service 4**: Provision of repositories for European open source scientific libraries and applications
 - **Service 5**: Evaluation of lightweight virtualisation technology
 - **Service 6**: Evaluation of new prototypes for Data Analytics services

Service 1 Urgent Computing

- ▶ A policy document for UC has been prepared and an operational chain has been proposed
- ▶ Many examples of UC cases were proposed by the interaction with the ChESEE CoE: most of them will be developed in the next future

Service 2 Links with Large-Scale Scientific Instruments

- **ESRF** (European Synchrotron Radiation Facility)
 - Five applications proposed by ESRF and four HPC Tier-1 centers volunteered
 - Despite some difficulties in the exploitation of the resources, the collaboration with ESRF will continue with PRACE-6IP
- **CERN** (Centre Européen de Recherche Nucleaire)
 - Many differences emerged in the access model and in the expected exploitation of the resources (not classically HPC)

Service 3 Smart Post-processing Tools Including In-Situ Visualisation

- Three different pilots:
 - SAIO, a framework that utilises a machine learning approach to optimise the parallel MPI/IO operations. Benchmarked and tested on many different architectures
 - In-situ visualisation plugin for OpenFOAM released for Paraview Catalyst
 - TileViz, multi-image tiling visualisation tool powered by statistical algorithms to ease the visualisation

Service 4 Provision of Repositories for European Open Source Scientific Libraries and Applications

- ▶ Core service based on GitLab, other components based on open source software (i.e. TRAC, RedMine, Jenkins, LDAP, CASino, B2SSHARE)
- ▶ For the moment, the access is provided only internally
- ▶ This will be considered as a regular service after the security review will be completed

Service 5 Evaluation of Lightweight Virtualisation Technology

- ▶ Following aspects have been investigated for container and virtualisation frameworks (Singularity, Docker, PCOCC, Galaxy-HTCondor):
 - ▶ Security: issues investigated and solved in most container platforms
 - ▶ Scalability: scalability tests proved that container applications are scalable
 - ▶ Performance: almost no performance issues (in particular for containers)
 - ▶ Deployment overhead: no significant overhead (some problematic cases related to HW driver, e.g. GPU or IB)
- ▶ Results of this work presented during the “5th Annual High Performance Container Workshop” at ISC19

Service 6 Evaluation of new Prototypes for Data Analytics Services

- ▶ Pilots:
 - ▶ Deep Learning SDK: synthetic benchmarks and astrophysics and CERN provided use cases
 - ▶ Spark Tools: focus on the Hadoop FS
 - ▶ Additional tools for advanced features (i.e. dataset download, DA Gitlab)
- ▶ Assessment of the performances and usability on different HW
- ▶ Produced results will be reported in a PRACE white paper

Link with other e-Infrastructures and CoEs (1/3)

- GÉANT
 - Several meetings to synchronise the activity (last one at EHPCSW 2019)
 - Experimentation with perfSONAR on the PRACE MD-VPN
 - Discussion on an AA infrastructure with AARC and eduGAIN
 - GÉANT is partner in the PRACE-6IP project

Link with other e-Infrastructures and CoEs (2/3)

▶ EUDAT

- ▶ Two joint pilots within DECI calls: CHARTERED2 and SubGridEoR
- ▶ Training activities: shared training materials and cross-reference for advertising the training events on the two websites

▶ e-InfraCentral

- ▶ Contribution to build a common catalogue of European data, compute and network services

Link with other e-Infrastructures and CoEs (3/3)

▶ LSSI

- ▶ Plan for collaboration and MoU (PRACE-GÉANT -CERN-SKA) are currently being elaborated

▶ CoEs and other e-Infrastructures

- ▶ In October 2018 a PRACE-EXDCI meeting with the CoEs and FET projects was held in Brühl (DE) to discuss common areas of interest
- ▶ WP6 was in charge of two sessions on “Operational services” where we lively discussed with other projects representatives
- ▶ In order to continue this interaction we created ad-hoc mailing lists
- ▶ A further meeting took place during EHPCSW 2019

Summary

- PRACE operates the common services for the Tier-0 and Tier-1 systems
- Several prototypal services are ready to be considered as regular services (i.e. repository, containers)
- Collaboration with other e-Infrastructures and other EU funded projects was strengthened

THANK YOU FOR YOUR
ATTENTION

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