

[INFRA] discussion

WLCG Workshop 2024, DESY

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**(towards a)
Heterogeneous
Grid
infrastructure**

- **The role of the WLCG Tier-0, Tier-1s and Tier-2s**
- **Integration of Cloud resources in WLCG**
- **Integration of HPC resources in WLCG**
- **Analysis Facilities**
- **General areas of work towards a more heterogeneous Grid infrastructure**

The role of the WLCG Tier-0, Tier- 1s and Tier- 2s

- **Background:** The To-T1-T2 hierarchy (dating back to MONARC) was instrumental for:
 - Data custodality
 - Lower the number of guaranteed network paths
 - Allow for different SLA levels at sites
- **Jobs are currently directed to sites in large part via this labelling. But sites are different:**
 - Technically
 - Financially
 - Operationally

In order to better use the hardware at sites, would more understanding of what is really deployed help? (*"a WN at Tier-2 XX can be quite different wrt a WN at Tier-2 YY"*)

- **[INFRA-1] WLCG to collect, organize and expose information about site capabilities (compute, storage, network)**

Integration of Cloud resources in WLCG

- **Background:** the use of Cloud resources (internal/academic and commercial) has been a reality in WLCG since > 10 years, albeit with limited overall impact on resources. Different models have been used. In some cases, Clouds have been used to offer significant *overpledge* capabilities.
- Still, a better integration is strategic for experiments, sites and FAs:
 - Experiments: access more resources (including commercial clouds and special facilities like the HLT farms)
 - Sites: deploy multi domain clouds, elastically extend to academic / commercial close-by clouds –pledge them?
 - FAs: deploy a nation-wide multi domain e-Infrastructure – use for pledges?
- **[INFRA-2] WLCG to collect information and document the technical solutions to integrate cloud resources with WLCG (internal)**
- **[INFRA-3] WLCG to establish channels allowing to follow the progress of other communities exploiting clouds (external)**

Integration of Cloud resources in WLCG

- **Background:** while Cloud processing is a reality in multiple cases, the use of commercial cloud storage as pledges has been scarce. When explicitly referring to commercial clouds, there are aspects like data safety, lock-in, changing policies, openness to be considered, on top of the technical aspects.
- **[INFRA-4] WLCG to define a commercial cloud storage provisioning policy.**

Integration of HPC resources in WLCG

- **Background:** HEP processing generally does NOT need HPC level hardware (i.e. fast node-to-node interconnect, “Platinum graded” CPUs, Accelerators, large shared disk areas ...). But our workflows can use HPC system to a certain degree of efficiency, if some minimal requirements are in place
- **Issues:**
 - Multi-year guaranteed access (HPCs are usually available via short time grants)
 - Technical and political suitability (be part of the HPC design vs be granted access a posteriori) – the capability to use accelerators
 - Specific (per site) effort needed to include them in WLCG processing (opportunistic / pledged)
- **Advantages:**
 - the “serial part” of LUMI has 262,000 AMD “Trento” cores, for an estimated 7 MHS₂₃; Leonardo 5 MHS₂₃. Not even considering the GPUs!

Elephant in the room: We can simply have “no other option”

Integration of HPC resources in WLCG

- [INFRA-5] WLCG to document existing solutions to integrate HPC centers and organize a knowledge base. When possible, propose one or more reference implementations via blueprint documents
- [INFRA-6] WLCG to construct a dialogue with the federations, funding agencies, and the relevant global bodies to drive the future allocation policies at HPC sites
- [INFRA-7] WLCG to leverage the relationship with the HPC centers and with the Funding Agencies to influence the architecture of future HPC centers also via interactions with the relevant international bodies
- [INFRA-8] WLCG to monitor the projects on national and global scale designing collaboration strategies for the collaboration with HPCs, and foster the participation of its members

Examples for a strategy for HPC Integration in WLCG

From Maria

Organize meetings to discuss HPC Integration into the WLCG

- Common and region-specific challenges
- Opportunities for co-design and co-development and common activities
- US region: process started, see below
- EU region: next, looking for a host:
Ideally co-located with an HPC site; Available to host a small workshop this summer

Goal is to develop and document the integration strategy

There are resources and ongoing activities that will be valuable input to the process

- US-CMS and US-ATLAS Cloud and HPC Blueprint ([here](#))
- Developing report from the HPC integration strategy focusing on the US ([here](#))
- Common Challenges for HPC Integration into LHC Computing ([here](#))
- EU-funded project SPECTRUM: <https://www.spectrumproject.eu>

Analysis Facilities

- **Background:** the experiments are planning specifically designed facilities to improve the user experience / the (speed of) physics output. There are technical and political aspects to these:
 - Specialized hardware with WLCG sites or just specialized services?
 - Compatibility between experiments, for multi-VO sites?
 - Pledged or not?
- **[INFRA-g] WLCC to explore how services and hardware supporting future analysis models could be hosted synergically with WLCG services.**

General areas of work towards a more heterogeneous Grid infrastructure

- **Background:** focus on the software aspects of heterogeneous computing (base architectures and accelerators):
 - Technology tracking of tools and solutions
 - High level programming frameworks, evolving C++ standards and compilers, ...
 - Benchmarking and accounting (e.g. Hepscore)
 - (pledging)
- **[INFRA-10] WLCG to prepare for heterogeneous compute architectures: facilitate the development of the offline software and progress in the area of benchmarking and accounting**

Evolution of WLCG services and standards

- **Background:** the WLCG infrastructure relies on services and standards, in good part developed by the same community. This implies (human) costs for the support, R&D, and security.
- In an increasing number of cases, non-HEP similar standards exist, often with larger reference use cases and support. But, moving is costly and can be risky (e.g. moving to a tools which ceases to be supported); how to treat legacy services?
- **[INFRA-11] WLCG to establish a process for adopting modern, non-HEP specific standards where appropriate and decommission legacy services and protocols. The process should include risk management for external dependencies**

General areas of work towards a more heterogeneous Grid infrastructure

- **Background:** some WLCG countries are planning / deploying computing resources with the purpose to create nation-wide "generic" (multi domain?) computing infrastructures, either federating existing infrastructures or adding new purpose-built centers. Changing role of service managers?
- **[INFRA-12] WLCG to follow and accommodate the national plans in terms of consolidating facilities, particularly when aimed at reducing complexity. Engage the service managers in the transition and retain expertise**