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On-demand provisioning of HEP compute resources on cloud sites and shared HPC centers

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This contribution reports on solutions, experiences and recent developments with the dynamic, on-demand provisioning of remote computing resources for analysis and simulation workflows. Local resources of a physics institute are extended by private and commercial cloud sites, ranging from the inclusion of desktop clusters over institute clusters to HPC centers.

Rather than relying on dedicated HEP computing centers, it is nowadays more reasonable and flexible to utilize remote computing capacity via virtualization techniques or container concepts.

We report on recent experience from incorporating a remote HPC center (NEMO Cluster, Freiburg University) and resources dynamically requested from a commercial provider (1&1 Internet SE), which have been seamlessly tied together with the ROCED scheduler [1] such that, from the user perspective, local and remote resources form a uniform, virtual computing cluster with a single point-of-entry. On a local test system, the usage of Docker containers has been explored and shown to be a viable and light-weight alternative to full virtualization solutions in trusted environments.

The Freiburg HPC resources are requested via the standard batch system, allowing HPC and HEP applications to be executed simultaneously, such that regular batch jobs run side by side to virtual machines managed via OpenStack. For the inclusion of the 1&1 commercial resources, a Python API and SDK as well as the possibility to upload images were available. Large scale tests prove the capability to serve the scientific use case in the European 1&1 datacenters.

The described environment at the Institut für Experimentelle Kernphysik (IEKP) at KIT serves the needs of researchers participating in the CMS and Belle II experiments. In total, resources exceeding half a million CPU hours have been provided by remote sites.

[1] O. Oberst et al. Dynamic Extension of a Virtualized Cluster by using Cloud Resources, J. Phys.: Conference Ser. 396(3)032081, 2012

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