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## Cloud-based Computing for LHAASO experiment at IHEP

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Mass data processing and analysis contribute much to the development and discoveries of a new generation of High Energy Physics. The LHAASO (Large High Altitude Air Shower Observatory) experiment of IHEP located in Daocheng, Sichuan province (altitude 4410 m), is expected the most sensitive project to study the problems in Galactic cosmic ray physics, and requires massive storage and computing power, which is urgent to explore new solutions based on cloud computing models to integrate distributed heterogeneous resources. However, it faces with high operation and maintenance costs, system instability and other issues. To address these issues, we introduce cloud computing technology for LHAASO in order to make sure the system availability and stability, as well as simplify system deployment and significantly reduce the maintenance cost. Particularly, we discuss the cloud-based computing architecture to federate distributed resources across regions for LHAASO experiment, including distributed resource management, job scheduling, distributed monitoring and automated deployment. Also container orchestration is introduced to make use of the load balancing and fault tolerance to improve system availability. The prototype is based on Openstack and HTCondor to achieve a unified resource management and scheduling job across regions transparently, located in Beijing, Chengdu and Daocheng, some commercial cloud also included like Alibaba Cloud. We also report a dynamic resource provisioning approach to achieve the resource expansion on demand and the efficient job scheduling, so as to improve the overall resource utilization. Considering serving data access from remote site, we design a remote storage system named LEAF to provide the unified data view, data cache as well as high performance of data access over WLAN. This presentation also will discuss the cloud-based open platform for LHAASO. The feature of the platform makes it possible to do data analysis by the web browser as data, software and computing resources are available in cloud. Finally, a proposal of integrating the HPC facility into the current computing system to faster LHAASO reconstruction jobs will be discussed.

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