

# Exploit the massive Volunteer Computing resource for HEP computation

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## Summary

It has been over a decade since the HEP community initially started to explore the possibility of using the massively available Volunteer Computing resource for its computation. The first project LHC@home was only trying to run a platform portable FORTRAN program for the SixTrack application in the BOINC traditional way. With the development and advancement of a few key technologies such as virtualization and the BOINC middleware which is commonly used to harness the volunteer computers, it not only became possible to run the platform heavily dependent HEP software on the heterogeneous volunteer computers, but also yielded very good performance from the utilization. With the technology advancements and the potential of harvesting a large amount of free computing resource to fill the gap between the increasing computing requirements and the flat available resources, more and more HEP experiments endeavor to integrate the Volunteer Computing resource into their Grid Computing systems based on which the workflows were designed. Resource integration and credential are the two common challenges for this endeavor. In order to address this, each experiment comes out with their own solutions, among which some are lightweight and put into production very soon while the others require heavier adaptation and implementation of the gateway services due to the complexity of their Grid Computing platforms and workflow design. Among all the efforts, the ATLAS experiment is the most successful example by harnessing several tens of millions of CPU hours from its Volunteer Computing project ATLAS@home each year.

In this paper, we will retrospect the key phases of exploring Volunteer Computing in HEP, and compare and discuss the different solutions that experiments coming out to harness and integrate the Volunteer Computing resource, finally based on the production experience and successful outcomes, we envision the future challenges in order to sustain, expand and more efficiently utilize the Volunteer Computing resource. Furthermore, we envision common efforts to be put together in order to address all these current and future challenges and to achieve a full exploitation of Volunteer Computing resource for the whole HEP computing community.

**Primary author:** Prof. WU, Wenjing (IHEP)

**Presenter:** Prof. WU, Wenjing (IHEP)

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