

# LHC Cloud Computing with CernVM

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Using virtualization technology, the entire application environment of an LHC experiment, including its Linux operating system and the experiment's code, libraries and support utilities, can be incorporated into a virtual image and executed under suitable hypervisors installed on a choice of target host platforms.

The Virtualization R&D project at CERN is developing CernVM, a virtual machine designed to support the full range of LHC physics computing on a wide range of hypervisors and platforms including end-user laptops, Grid and cluster nodes, volunteer PC's running BOINC, and nodes on the Amazon Elastic Compute Cloud (EC2). CernVM interfaces to the LHC experiments' code repositories by means of a specially tuned network file system CVMFS, ensuring complete compatibility of the application with the developers' native version. CernVM provides mechanisms to minimize virtual machine image sizes and to keep images efficiently up to date when code changes.

CernVM also provides interfaces to the LHC experiments' job submission systems and workload management systems (e.g. ATLAS/PanDA, LHCb/DIRAC, ALICE/Alien), allowing clouds of CernVM-equipped worker nodes to be accessed by the experiments without changing their job production procedures.

Currently supported clouds include Amazon EC2, private clusters, Tier3 sites, and a cloud of BOINC volunteer PC's which represents a very large potential resource, so far untapped by the LHC experiments.

This paper presents the current state of development of CernVM support for LHC cloud computing.

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