

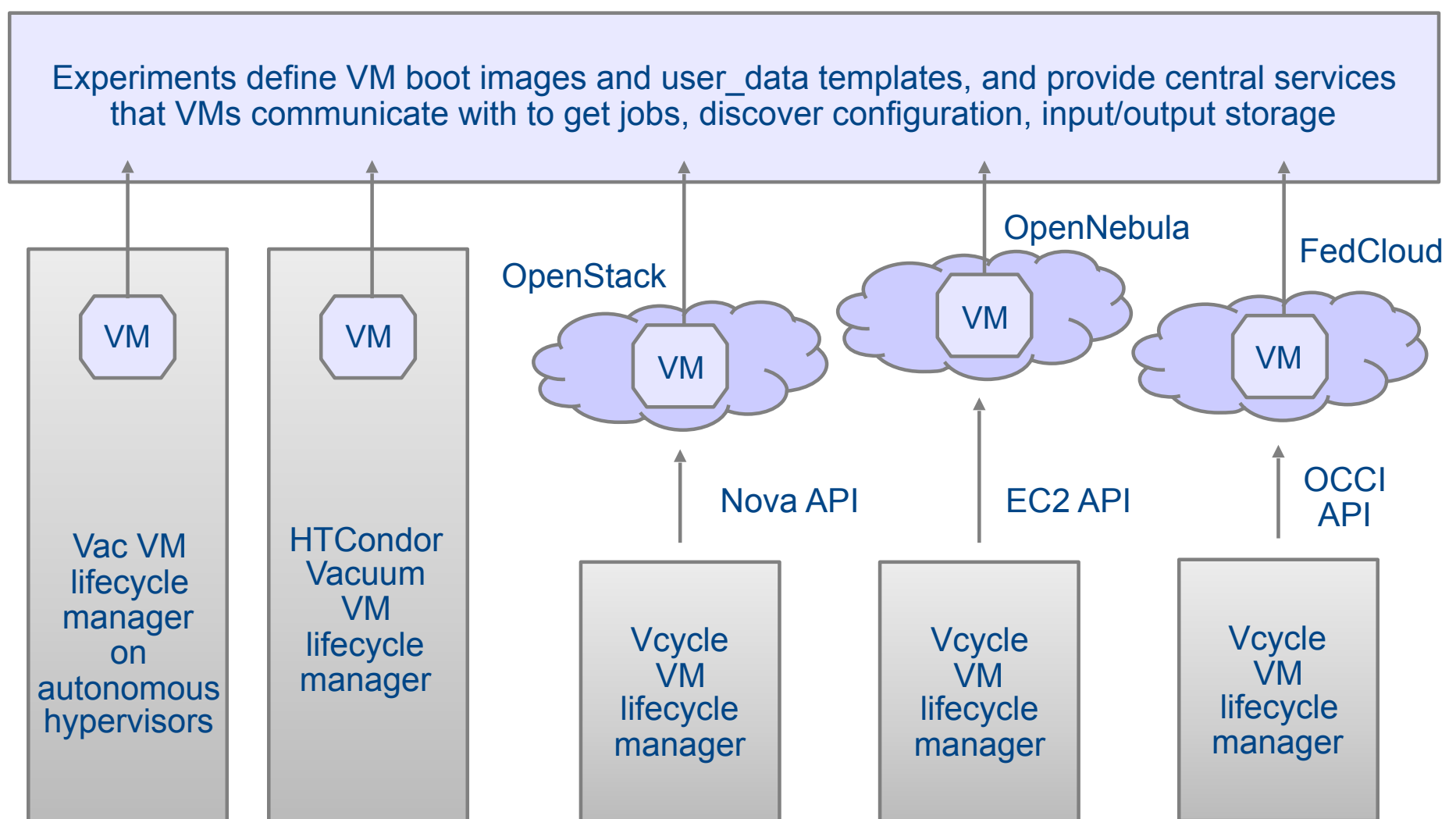
The Vacuum Platform presents uniform APIs between Virtual Machines and the Virtual Machine Lifecycle Managers which control them. It has been developed by GridPP to allow sites to run VMs provided by the LHC experiments and others, using GridPP's Vac and Vcycle VM lifecycle managers.

The basis of the platform are the \$JOBOUTPUTS, VacQuery, and VacUserData interfaces plus requirements for using Machine/Job Features, APEL, and GOCDB. The specification also describes how experiments should publish the boot images and contextualization of their VMs.

The platform is described in detail in HEP Software Foundation technical note HSF-TN-2016-04, "Vacuum Platform".

Where possible, the specification encourages the use of OpenStack APIs for booting and metadata discovery, either on native OpenStack or by compatible implementations such as Vac. For other cases, alternatives are described which can also be supported for maximum portability of VMs.

The overarching aim is that a single VM definition for each experiment will be able to run at all sites.



The platform has been driven by operational experience gained by GridPP and the experiments in running jobs in VM-based systems. We are especially interested in ways of reducing the effort required to run a site and the lightweight site concept. In particular, to reduce the amount of manual effort required to install, configure, and maintain sites.

The components of the platform support these goals. For example, experiments are encouraged to publish the HTTPS URL of the boot image used by their VMs, which the VM lifecycle managers automatically download and cache when new versions are available. This removes the need for site administrators to manually fetch new versions, and gives the experiment's operations team direct control of which version is in production across the sites.

Nevertheless, the platform is designed to integrate with the existing WLCG/EGI infrastructure, including at mixed sites using conventional grid middleware and VM-based approaches at the same time. Accounting information is reported using APEL and it is encouraged that resources will be registered in GOCDB as with other CE types. Limits on available CPU time, number of processors etc are published to the VMs and jobs using the WLCG Machine/Job Features mechanism.

Some components of the API may also be of wider interest. These include the VacMon specification for communicating VM status between co-operating VMs at a Vac site, which is also being used by GridPP to publish monitoring messages to a central site; and the \$JOBOUTPUTS extension to Machine/Job Features which allows VMs (or batch jobs) to communicate log files to sites.