

# Deploying and extending CMS Tier 3s using VC3 and the OSG Hosted CE service

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CMS Tier 3 centers, frequently located at universities, play an important role in the physics analysis of CMS data. Although different computing resources are often available at universities, meeting all requirements to deploy a valid Tier 3 able to run CMS workflows can be challenging in certain scenarios. For instance, providing the right operating system (OS) with access to the CERNVM File System (CVMFS) on the worker nodes or having a Compute Element (CE) on the submit host is not always allowed or possible due to e.g: lack of root access to the nodes, TCP port network policies, maintenance of a CE, etc. The Notre Dame group operates a CMS Tier 3 with ~1K cores. In addition to this, researchers have access to an opportunistic pool with +25K cores that are used via lobster for CMS jobs, but cannot be used with other standard CMS submission tools on the grid like CRAB, as these resources are not part of the Tier 3 due to its opportunistic nature. This work describes the use of VC3, a service for automating the deployment of virtual cluster infrastructures, in order to provide the environment (user-space CVMFS access and customized OS via singularity containers) needed for CMS workflows to work. Also, its integration with the OSG Hosted CE service, to add these resources to CMS as part of our existing Tier 3 in a seamless way.

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